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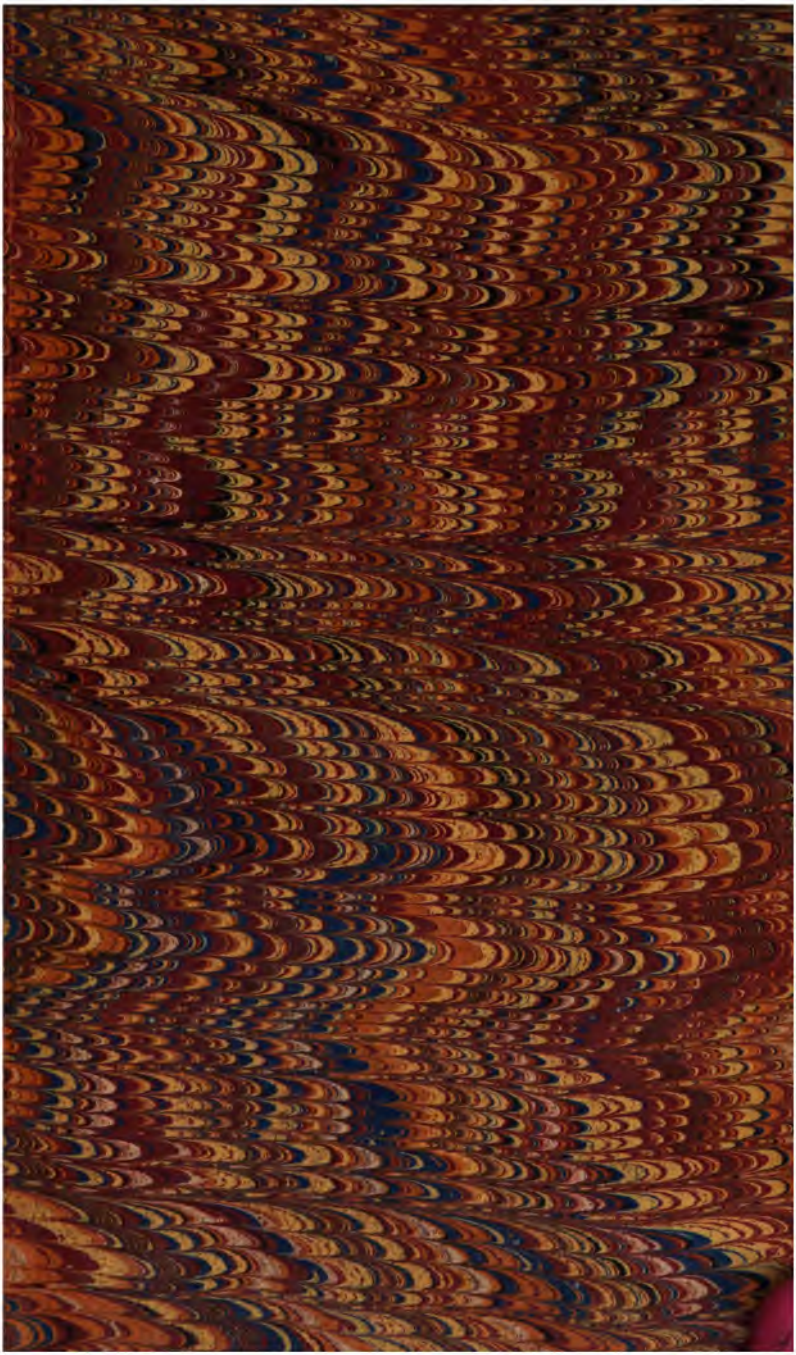
FIRST BOOK
FOR THE ARMY
BY ALFRED DOWNES.



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MANUAL

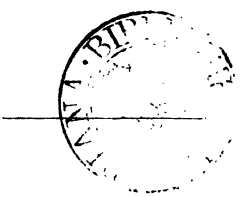
OF

INFORMATION AND INSTRUCTION

FOR

CANDIDATES FOR COMMISSIONS.

By ALFRED DOWNES.



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INTRODUCTION.

THIS work is intended to supply the place of oral tuition, at a time when locality or other circumstances render it difficult to obtain instruction. That it should be a very indifferent substitute, is the necessary consequence of dispensing with the judgment of the teacher, as applied to the particular wants of the learner, and supplying its place by general directions applicable to all minds alike; but by shewing how to begin the task, it may at least prevent the entire loss of time, and obviate that extreme discouragement which misdirected labour is apt to produce.

There are very few who have the good fortune to obtain a commission so early in life as to allow them to pass at once from the school-room to the army; more commonly there is an interval, during which the candidate is said to be waiting for his commission, and which he is apt to employ in ways by no means calculated to extend and arrange his school education; if any thing contained in these pages can induce him to apply himself to the study of his profession, and can facilitate his progress, the purpose with which they were written will be fully answered.

It may be well to forewarn the reader, that nothing like a system of "*cramming*" has been attempted, if by

that term be understood a device for slipping through the examination, upon the least possible stock of information. Whatever conclusions private experience may have led me to draw, I have not felt myself at liberty publicly to assume that any candidate for the army deliberately lays himself out to defeat the intentions of the authorities, and to evade the spirit of the first order he receives from his military superiors. The directions given will always be based upon the supposition, that time is to be economised, but the work to be done thoroughly. A few remarks will usually be found upon branches somewhat higher than are required for the examinations; these are intended for the guidance of such enterprising students as desire to become not only successful candidates, but accomplished officers.

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MANUAL

FOR

CANDIDATES FOR COMMISSIONS.

CHAP. I.—LANGUAGES.

CRITICAL ANALYSIS OF CLASSICAL LANGUAGES NOT TO SUPERSEDE THE STUDY OF ANCIENT LITERATURE—MEANS OF REPAIRING A DEFECTIVE EDUCATION—PRACTICE OF THE LATE DOCTOR LEYDEN—USE AND ABUSE OF TRANSLATIONS—IMPORTANCE OF ATTENTION TO COMMON INFLECTIONS—PARSING—THE MODERN LANGUAGES—OLLENDORF'S SYSTEM—CONVERSATION—READING POETRY ALOUD—HABIT OF THINKING IN A FOREIGN TONGUE.

ALTHOUGH to military men the modern languages are undoubtedly more useful than the ancient, I shall give to the latter their prescriptive right of precedence, the more readily that the class to whom these pages are addressed, have, for the most part, been prepared by early education for their discussion, and possess a fair insight into their elementary construction.

By the industry of many generations of scholars, the system of classical education has been brought to a surprising completeness, and is now as much valued for a training in the art of critical analysis as for the literature it places in our hands. It may be doubted, however, whether one of these branches has not of late years encroached too much upon the other; and whether classical schools have not rather neglected the treasures bequeathed by ancient civilization in favor of the vehicle in which they are conveyed. If the time consumed in learning and applying minute grammatical constructions, and in the composition of thousands of verses, were devoted to

an extended course of reading, not only would a taste for classical literature be more generally diffused, but time might be spared for subjects of common utility, and such advantages would, perhaps, be cheaply purchased by the loss of one or two profound scholars and a few abstruse treatises. The proportion of students whose lives will be devoted to the study of language will seldom be more than one in fifty, even in a public grammar school. For these it may be true, that too much pains cannot be bestowed upon the acquirement of those habits of thought necessary for critical analysis; but to men destined to mix actively in the affairs of the world, a more familiar, and less exact, knowledge of the dead languages would be more pleasant—an intimate acquaintance with the living more useful. It is certainly an unhappy system which sacrifices the time of the many to the interests of a small minority.

Such a familiarity with Greek or Latin as would lay open the ideas and information embodied in those languages, might probably be obtained in two or three years' study; and the young scholar might then hope to extend his reading among the classical writers in search of historical information or even amusement. But on the system at present pursued, only those who enjoy the advantages of considerable talent and industry with a long school education, overstep the rudiments of the languages or lay open the treasures they contain; and but few even of these can turn to Greek or Roman writers as they would to English authors for relaxation and enjoyment. It is even said by some competent authorities, that, as a distinct science, the analysis of classical languages has been carried too far, and is already declining into a narrow pedantry similar to that which marked the decay of literature and science among the ancient nations. This will not seem improbable, when it is remembered how many acute and indefatigable scholars, after acquiring as schoolboys a more exact knowledge

of Greek and Latin than belonged to Demosthenes or Cicero, have considered the rest of their lives usefully and honourably spent if they could establish a doubtful metre in a Greek tragedian, or add one more to the hundred existing readings of an obscure passage. The knowledge of a particular language is not progressive and unlimited, like the abstract sciences, but like the soil, presents its most natural fruit to the first rough cultivation; and if labour and ingenuity are continually straining for increased supply, a point must at length be reached at which the harvest no longer repays the labour. When this culminating point is passed in the study of any language, and the rising generation will not turn its energies into other channels, the advances made will be apt to become mere literary *fashions*, more specious than real.

Let it not be supposed, however, that I wish to advocate a loose and superficial method of classical education; or that I underrate the ingenuity and learning which have built up the system of our public schools. Probably that system is as efficient as any that could be proposed for the formation of profound scholars, and is not without value as a discipline for the mind; but those whom I address have reached an epoch in their lives when time can no longer be expended without the certainty of a direct return. If they have not yet attained a solid grounding on the old method, they cannot remedy the defect; and I offer the foregoing remarks as an explanation of the reasons which lead me to propose an entire change of system.

Nothing is more common than to meet an expectant candidate for a commission, whom the mismanagement of others and his own indolence have placed in something like the following position. He has spent the important period of eight or nine years at what was considered an excellent grammar school, and is therefore supposed to enjoy a sound liberal education, and to be ready

with a few weeks' preparation for any examination that can reasonably be required. As it happened, however, that the school was not mathematical, his acquaintance with that subject never went beyond the rule of three; and although in French he took lessons three times a week, yet as the language was rather looked down, and as he never gave it any serious attention, he now remembers scarcely even the regular verbs. Of Geography, History, and general subjects, he knows absolutely nothing, the classical tendencies of the establishment having never been disturbed by such pursuits; and, finally in Greek he did not rise high enough among the classes to get much beyond the accidence. Now it is certain that eight years of life, and a large sum of money have to be accounted for, and as nothing remains but Latin, his friends have some right to expect a most substantial scholarship, and an extended course of reading as the fruits of so much time and outlay. Unfortunately, in cases where the previous description applies, it will be found with scarcely an exception, that the whole knowledge of Latin consists of an imperfect recollection of the accidence, a few rules of syntax learnt by rote, and a slovenly acquaintance with *Cæsar's Commentaries;* other books have perhaps been read, but so slightly, that no trace of them remains on the memory. It is, in short, an open question whether it will be more easy to refresh the Latin and pursue it through the moderate course required for the examination, or renounce it entirely in favor of French or German.

The student has thus only the choice between evils, as whichever course may be adopted, a considerable period and much laborious attention will be required before the necessary standard can be attained; and the task is rendered more repulsive by the recollections of confinement and weariness with which the study of grammar has become associated. Nor can he indulge any hope of escaping this penalty of his misused years. To pretend

that any method of acquiring a language can dispense with the use of industry and self-denial, is the act of a charlatan. Whatever educational theorists may believe, all practical men will agree that the accidence are a real and unavoidable difficulty; declensions and conjugations cannot be picked up like flowers by the way-side, but must be won by resolution, like the hundred other prizes with which the path of life is strewed. Still there are methods more and less tedious of attaining the same end; and as in the present day none can afford to choose the worst path, I shall recommend a plan which has the sanction of very high authority, and which, without neglecting the grammar, lays open the heart of a language as a medium of thought, as quickly and easily as any that can be chosen.

It was the practice of the late Doctor Leyden, in the multiplicity of languages which he studied, to confine himself at first to the narrowest elements of the grammar, such as the character and a few of the most useful verbs and nouns, and then to read through two or three books as quickly as possible, without pausing to examine the grammatical construction further than was requisite for ascertaining the sense. By this custom, which he termed breaking the back of a language, he gained the advantage of penetrating at once into the more interesting part of his subject, and at the same time acquired that sort of instinctive consciousness of the grammatical construction which a native might possess who had never studied it as a science, which we all possess in regard to our own tongue, whether we have confined ourselves to the Eton Grammar, or have waded through Lindley Murray.

But in applying his system to Eastern languages, this eminent scholar had difficulties to contend with, which do not belong to Latin, French, or German; for in many of the dialects which he studied no printed books existed, and he was compelled to pick his way through ill-written

manuscripts, with a very indifferent lexicon, if any, and necessarily without any hope of a translation.

In the books usually read for military examinations, accurate English versions may be obtained, and I do not hesitate to advise the student to make the most of their assistance. With the aid of a good translation, ten pages may be read where one could have been done with the Dictionary; nor is it quite certain, as is often assumed, that subjects which are plodded through on the old method are learned better or retained longer than those which have been *carefully* read with a translation. In searching for a word in the lexicon, the time is for the most part employed in the manual occupation of turning over the leaves, and the eye is wearied by ranging over the initial letters without any simultaneous exercise for the mind. The only real advantage of such a method consists in the effort which is required to extract the meaning of the sentence when all the words are known, and it is the necessity of this exercise, and the difficulty of enforcing it by other means which present the chief obstacle to the use of translations in a school.

In addressing my adult students, however, it cannot be necessary to seek for methods which will *compel* attention to a point of self-evident importance; it is, or ought to be, sufficient that they see the reason for any practice recommended. I have therefore advised the use of translations, and need only add this one condition, that the English should not be referred to, until a strenuous effort has been made to find the sense of the passage without its assistance. A habit prevails rather too generally of reading the English of each sentence before turning to the Latin, by which means a few books may, indeed, be very quickly skimmed through, but no real knowledge of the language can be obtained: whereas, if the translation be used sparingly, it greatly expedites the reading, without diminishing its efficacy. Let it be remembered that the time lost in pondering at the beginning of a work, will be regained towards

the end, from the familiarity it gives with the author's phraseology; and at the second perusal, the translation may often be dispensed with altogether. A safe general rule will be to use the English version just in the same manner as we should employ the dictionary, that is to say, when it can by no means be avoided. If the latter could be referred to without trouble, its assistance would be abused by too frequent reference, nay, it is so abused now in many cases, with the hope of substituting manual action for the mental labour of searching the stores of the memory, a habit which is kept within bounds by the irksome character of the operation. I propose to the student to check by an exercise of sense and firmness, the abuse of the translation, in the same way that personal indolence limits the abuse of the dictionary.

It would, however, be useless to read any work without some knowledge of the accidence, at least of those common inflections which occur in every sentence. The declensions and the regular conjugations are indispensable, and the shortest way will be to learn them by heart. Those who have ever been familiar with these subjects, will easily recover them; but if there be any who have not studied Latin at school, they have certainly a serious task before them, and there is no hope or remedy but in industry. It is not, however, at all necessary to repeat every verb through from beginning to end, as if in a class. All practical purposes may be gained by such an acquaintance with each inflection, as will enable the student to recognize it whenever he meets it, and to associate it readily with its English meaning. Some portions of the verb will also be found to prevail more than others, in particular books, and might receive especial attention; thus, in historical works, the third persons singular and plural will naturally predominate, and the present infinitive is constantly employed instead of the third person of the imperfect. In the Commentaries, these forms will carry the

student through the whole work, with the exception of a very few passages.

Whatever book may be read, it is absolutely necessary to give considerable attention to the parsing, which will not, by any means, come of itself on the plan of reading here proposed. It would be well to preserve a settled proportion between the quantity read and that which is analysed; as for example, five lines of the one to every hundred of the other, and as the parsing is rather irksome, especially to beginners, the student should always suspect himself of an inclination to evade it. A few weeks perseverance in parsing will give considerable facility in the inflections most prevalent in any particular author, and it will be desirable as early as possible to apply the rules of Syntax, which it need hardly be observed should be learnt in English, not in Latin. Many editions have been published of the works commonly read, and some of these give material assistance by notes explaining the grammatical construction; it will scarcely be necessary to recommend such works in preference to those which give the bare text, or ingeniously wrap up their explanations in Latin. Where Anthon's editions can be obtained, they will generally be found extremely useful.

It would occupy too much space to follow the reader through the whole of his Latin subjects, and indeed a commentary on Cæsar, Virgil, and Livy would be quite superfluous; I shall, therefore, close the subject with a few remarks on the different methods of acquiring the modern languages.

In commencing French or German, it will be of the greatest importance to have the assistance of a competent master. Bad habits of pronunciation are extremely difficult to break through, and more real progress will be made in three months under good tuition than could be attained alone in a twelvemonth. If a residence in the country can be managed, it will far exceed all other advantages, and, indeed, will almost supersede the neces-

sity of directions, as there is scarcely any system of tuition which will fail under such circumstances to make a good scholar. But it must not be supposed that study and instruction can even then be altogether dispensed with. It is quite possible to live in France or Germany for years without acquiring any thing beyond a scarcely intelligible jargon, and without some guidance and care there is great danger of wasting the valuable opportunity. If, however, the student will pay a reasonable attention to grammar and accent, and will talk and read as much French or German and as little English as possible, he cannot fail of attaining a sound practical knowledge of the language.

A more difficult task awaits the learner who has never resided abroad and cannot now leave England. There are, indeed, a multitude of systems which profess to teach a language in the shortest period, some, indeed, in less time than would be necessary in the country where it is spoken; but such golden promises should be distrusted, and the method which offers too much should be avoided.

The system of Ollendorf is, perhaps, the only modern plan which deserves serious attention. It professes to teach a language to the extent of reading, writing, and speaking in six months—a proposal which certainly holds out great encouragement, but not of so extravagant a character as to be beyond all belief. This system was first adapted to the German, and has since been applied to most of the continental languages; while the justly celebrated works of Kerchever Arnold are a modification of the same method to suit the peculiarities of the classical dialects. The rapidity with which this system has spread through so many nations is a pretty safe guarantee of its merit; nor would it be easy to study any work on that plan without deciding that it was founded in truth and common sense. One advantage which most students will appreciate is, that of laying out each day's work in a separate lesson, so that the learner knows exactly what has to be done in order to attain the proper rate of

progress. The lessons, it must be admitted, are rather long, and many will find it necessary to shorten the work by reading a portion of the exercises instead of writing them, a task which should always be performed aloud, and in the presence of an authority who can correct mistakes.

It would not be advisable, however, to rely entirely upon Ollendorf, which is no more than a grammar and exercise with a copious vocabulary. The student should also go through a course of reading, to which the remarks that were made in reference to Latin apply in a still greater degree. In modern languages the shortest way of getting at the meaning is, unquestionably, the best, as it assimilates more closely to the natural mode of hearing and conversation, and the sooner the habit of reading and understanding the language without translating is acquired the better—an advantage which can scarcely ever be obtained upon the dictionary system.

There is also great advantage to be gained by reading poetry aloud, and some would say, by learning it by heart. The peculiar cadence of the language, so difficult for a stranger to acquire, is certainly more likely to be gained by this means than by any other, short of residence in the country. But it must be borne in mind, that the assistance of a native of the country is quite essential to the efficient application of any such method. If a French master would read poetry to his pupil, and hear him read it verse by verse after himself, he would probably get through the main difficulties of the accent in a few months. As to speaking French, so as to be mistaken for a Frenchman, it is needless to say that it can only be obtained by years of foreign residence; many never attain it; and it is believed that no adult can acquire a true French accent, unless the organs of articulation were in some degree exercised in it during childhood.

Bearing in mind that neither speaking nor writing in a

foreign language can be accomplished properly until the power of thinking in that tongue be acquired, it should be the constant aim of every student to adopt such measures as will train his thoughts to frame themselves in the language he is studying. Conversation is undoubtedly the most efficient practice; and it is astonishing how soon, under favorable circumstances, the mind begins to work at its new task. In the absence, however, of opportunities for such intercourse the nearest approximation, I am inclined to think, will be found in general and diffuse reading, and that not so much in the manner of a study, as by a mere skimming in search of amusement. Such reading would, of course, never make a scholar by itself, but combined with an hour or two of careful study daily, it would do so as quickly as any method of which we have the command in England. The long array of French novels would, therefore, be a rich and pleasant resource were it not that the vile moral code which many of them follow, renders them an absolute poison to a mind in which any trace of purity remains. There is, however, an abundant supply of travels, memoirs, and other light literature, and in the latter especially, the French language is exceedingly rich. Among many of these the student may exercise himself without any danger of finding his interest flag. He will thus gain a double advantage, not only pushing his knowledge of French as far as a residence in England will allow, but familiarizing himself in an easy and agreeable way with those minor points of history which throw a light on the chronicles, not only of the land to which they belong, but very often on the most interesting transactions of his own country.

Chap. II.—HISTORY.

TEXT BOOKS—DIRECTIONS FOR READING IN GENERAL—APPLICATION OF THE PLAN TO THE STUDY OF HISTORY—RATIONAL METHODS OF LEARNING BY HEART—USE OF ACCIDENTAL ASSOCIATIONS AND REAL ANALOGIES—COMPILATION OF CLASSIFIED TABLES OF EVENTS RECOMMENDED—MILITARY HISTORY—CAUSES OF WARS—ATHENS, ROME, AND SPARTA COMPARED—FEUDALISM—HINTS ON A MORE EXTENDED COURSE OF STUDY.

IT is usual to commence the study of History with some work containing an outline of events in a small compass. By this means the leading incidents become familiar before the details are noticed, and will always retain the same prominence however thoroughly the subject may afterwards be investigated. Treated on this method there are few subjects more easy to acquire and it will be admitted, that few are more necessary in reading or conversation; but the treatise adopted as a text book must be chosen with great care, as a false impression acquired at the commencement will not afterwards be easily obliterated.

The readers of these pages are relieved from a portion of the responsibility incurred in the choice of their text book; they will naturally adopt those recommended by the authorities among which some of the best that have yet been published may be found. The requisites for a useful compendium are, brevity, clearness, and a judicious choice of facts, that matters of real importance may not be omitted to make room for trifles. But the generality of elementary books have not kept these requisites in sight, there being a certain class of incidents as agreeable to writers as to readers, and therefore tempting both author and student to dwell upon them more than their real importance requires. Hence, a great part of our school books are a mere medley of anecdotes with little purpose

or connection, and having about the same relation to true History that a collection of the beauties of an author bears to one of his works.

The proper compendium being provided, the next care must be to read it, a point in which every youth fresh from school will believe himself to be an adept, but in which it is not too much to say that the greater part of men of all ages are deficient. Reading to useful purpose must include understanding and remembering; and although some may be found who retain with little difficulty all they see, it is the complaint of most students as soon as they begin to know themselves, that a great part of their acquirements are forgotten before the day is ended. It is indeed quite possible to scan with the eye, and even to articulate every word without taking in the sense of a single phrase; and it is also very common to read, and for the moment understand without retaining any part in the memory. It may be well, therefore, to begin with a few directions for reading in general, before applying the art to History in particular, as it seems useless to show how information may be sorted and arranged to those who have not yet learnt how it may be acquired.

When a young student first attempts to read for his own improvement, without the fear of a repetition before his eyes, he usually peruses the book from beginning to end, in much the same style that he would have treated a novel, taking it for granted that he will remember all he requires. At the end of his task, he remembers very little. A second perusal gives a better acquaintance with the striking points, but leaves him still very deficient in the details; and if he has the perseverance for another revisal, it will often be found less efficacious than those which preceded. The reason is evident, the mind has not followed the eye. The system must therefore be altered, and a plan adopted which will compel the inward and outward sense to work in unison. This can only be

done by constant examinations, by acting in fact as his own school-master, and by getting through his work in short lessons repeated to himself; relinquishing, however, the habit of learning by heart, and endeavouring to remember and understand upon the first perusal.

To accomplish this, let a single paragraph be read, with great care, and deliberation, and let an attempt be then made to repeat it from beginning to end, not necessarily in the words of the book, but without missing any part of the sense. Some will find this a very easy task, others will have forgotten every sentence. The latter must diminish their quantity, for though they cannot fix their minds sufficiently to retain a paragraph of ten or twelve lines, they will probably find no difficulty in managing an ordinary sentence. In either case, as soon as one or two pages have been perused and repeated in these sections, they should all be read together, and an attempt made to go through them from memory; if it be done with facility the quantity may be increased, and in other cases, if necessary, diminished. When such a practice has been continued for a few days, it will become extremely easy; and those who could scarcely repeat a sentence at first will accomplish ten or twenty lines without difficulty.

The want of retentive power is not necessarily a symptom of mental deficiency, it does not even prove a bad memory, but arises commonly from want of training or from the habit of reading works of fiction, in which young people usually seek nothing but the story. The short steps here recommended need not dissatisfy the most impatient student; those who can remember a greater quantity at a time should by all means do so; but those whose distaste arises from the irksomeness of the repetition may take it as a proof that it is more than usually necessary. They are either too anxious to pass over the chapter at the risk of doing it badly, or they find names and details troublesome to retain. A good memory is seldom unwilling to try its strength.

It is of importance that each sentence should be read only once, as it is very necessary that the mind should be trained to understand, and the memory to retain at the first attempt, and thus prepared for the studies or business of after-life, when there is little time for repetition. The second perusal, which is to be resorted to after an interval, is necessary for those who have to stand an examination, and they will often require to go over the work a third time, observing, however, that the second reading should take in passages four or five times as long as the first, and the third should bear a similar proportion to the second. The repetition of passages should be confined to the day on which they are first met with. It is a mistaken, though common practice, to keep up by constant revisal all the previous work. Some good authorities may be found for such a practice, and it has even been recommended to repeat the work of each day at the commencement of the next, and of each week and month at the commencement of those periods. But for reasons which will now be given, such a practice appears undesirable in studying an English work, however advantageous it may be found in the classics.

The early part of a book that has been read through with reasonable care does not usually escape the memory entirely, but leaves behind certain impressions, more or less vague, which are revived with peculiar distinctness upon a second perusal; and matter that has been learnt thoroughly at first, and after being apparently forgotten, has been renovated, will be retained longer than if the same amount of pains had been bestowed in daily repetition. By allowing the first part to settle in the mind, there is also more hope of obtaining a comprehensive view of the subject, for the perusal of the two extremes is not then separated by a long interval of time. On the second reading, all will be about equally familiar, and the impression formed will be founded upon the whole, and not upon a part; while if daily repetition be adopted, the early

part of the work becomes familiar before the sequel has even been read, and crude notions are impressed which are not always easy to correct. Besides this, there is an evident advantage in availing ourselves of the last opportunity that will occur for training the mind for future reading, in which repetition will seldom be attempted; and for making the indispensable transition from the mechanical to the intellectual use of memory—from the studies of a boy to those of a man.

The student is, therefore, recommended to push straight on with his book from beginning to end, repeating detached passages as before proposed, but leaving each day's work to shift for itself until the book is completed; he will thus feel his daily progress through the task, and at the same time will be acquiring the two essentials of reading, the power of fixing the thoughts, and a retentive memory.

In the study of History it may be necessary to modify this plan in some degree owing to the peculiar difficulties which are to be overcome, as well as to suit particular defects in the memory of the reader. Some find great difficulty in retaining proper names, and would save time by writing them down, and repeating them every day; there are probably none who could remember dates without special attention. It will be necessary, therefore, in each day's reading to write a short list of the most prominent events with their dates, and learn them thoroughly by heart: they will then prove a great assistance in impressing what has been done, besides making the names of places and men more familiar. They should be repeated straight through from beginning to end, and kept up by daily practice that the order of events may be as familiar as the details. It is the only use that need be made of the method of learning by rote; and even this may be done on a more or less rational method.

Many are in the habit of learning by the mere force of

repetition without making any use of the understanding, trusting to the motion of the lips to accustom the muscles of articulation, to act in a particular order in the same way that the fingers of a musician will continue a familiar performance while his mind is otherwise engaged. In this way a great part of our early education is acquired, such as the multiplication table, and the verbs and declensions of foreign languages; but it seems unwise in after-life to throw the mind into inaction when it might be busy in observing minor connections and analogies, often as valuable as the subject itself. The better plan is, to call the understanding as much as possible into play, noticing every circumstance which may assist the memory. Thus the interval between two events, may sometimes help in retaining both, a coincidence whether real or accidental, even a sequence in the figures, or the frequent repetition of the same unit may be found useful. In short, as the choice of evils it may be admitted that any plan which keeps the mind upon the subject, is preferable to one which allows it to wander. There will at last be some dates which elude all efforts to hold them, and required to be subdued by mere repetition, in doing which about half the time may be saved by practising them in a clear voice calculated to make an impression upon the ear.

The methods to which the name of *memoria technica* has been given, have lately become popular; and when on a good system, they undoubtedly afford a ready means of acquiring a certain number of dates; but they give no training to the memory, and therefore, when the figures embodied in certain words and in a doggrel rhyme are exhausted, the student has no means of adding to their number. On the other hand, in learning figures independently of such aids, the memory strengthens with wonderful rapidity, each day not only accomplishing its own work, but facilitating that of to-morrow, so that at the end of the course a faculty has been acquired which will be of

essential though unconscious service at every period of life.

Whatever method however is adopted, the list of dates must be learned thoroughly, and kept up by constant repetition. It will recompense the trouble by many important advantages even in the act of learning; not only are names and intervals rendered familiar, but the chronological order of events which is the skeleton of History, is permanently impressed; while collateral circumstances and characters are continually passing through the scene, either fixing themselves in their place, or exerting enquiry as to the proper station.

In following this method of reading, it will be observed that every part of the History is read twice or three times, and repeated as often from memory, it is also kept up in some degree by the constant repetition of the list of dates; the student, therefore, when he has finished his volume *ought* to be able to take up the thread of the narrative at any given point, and continue it with tolerable accuracy as far as he thinks proper. He ought also to answer any questions, and to place any prominent character in its proper place in chronology. But if the reader will observe what passes in his mind while endeavouring to recollect any isolated event, he will find that his train of thought has been far from logical. One incident will be recalled by its position at the beginning or end of a chapter, another will be dependent upon its date instead of the date waiting upon the circumstance; and some will be brought to mind by a quaintness or peculiarity in the author's language. These accidental associations may be admissable in the first struggle with a new subject; but it is desirable as soon as possible to lay aside all artificial support, and trust only to reason and real analogy. Arbitrary connections will not bear the test of time, assisted by the study of other subjects; and even those who aim no higher than the examination, will require a surer basis.

The first reading will generally give some knowledge

of the thread of the story, and the habit of learning a table of incidents with their dates, will have taught the order of events. But everything has been trusted to memory; and if that fails, there is no course of reasonable connections by which the defect can be remedied. It is necessary then to support the memory, either by the mechanical process of incessant repetition, or by establishing such relations of cause and effect as shall enable us to fill up a blank by an effort of the understanding. For reasons already given, the latter seems preferable; and the object may be gained by dividing the transactions into certain classes, and examining each class separately, instead of combining them in one table. Thus, on the second perusal of the compendium all associations merely accidental will be broken up, and incidents which really influence each other will be more closely connected.

The divisions which naturally present themselves for this purpose are, military history, constitutional history, and biography. The first includes all wars, civil or foreign, with their battles and military movements, and the treaty. It addresses itself particularly to military men, who have greater advantages for understanding it than others, and to whom it is profitable in a professional point of view. The second involves all those legislative operations which have affected the nation by changing its form of government. In the eye of the statesman, it is the highest branch of history, and is the property of the thoughtful student of whatever profession. The last division relates in a monarchy to the successive sovereigns, who alone have a right to merge their personal history in that of the nation. In democratic countries, it includes all those who have attained such a degree of influence as to be considered the chief men of their state.

In each of these classes the student will do well to make out a table or list. One to mention every important war, with battles, treaties, and eminent commanders. Another to record every constitutional change, using the name by

which it is commonly known, and connecting with each a short sketch of its provisions, and of the men by whom it was forwarded or opposed. The third will be a list of the sovereigns or rulers, of whom he should mention any very prominent action; and in regard to the former, any marriage which led to important political consequences.

These lists are not intended to be learnt by heart, the act of making them out with the exertion of memory, and discrimination necessary for that purpose will be a great part of their utility, although they will also be very serviceable for reference and self-examination. The advantage of observing the actions of a people in three distinct channels will be gained by this means; and where memory fails in one case it may be supplied by reference to another. It will be found also that a much greater uniformity of impulse is visible in the history of a nation when contemplated in one separate branch, than when all its transactions are taken together. Something of a general tendency, a set of the tide may be traced in the constitutional or military history of any nation, which fixes upon it the stamp of national identity. We thus not only obtain a more lively impression of the character of the people, but correct the tendency to break up its annals into detached incidents, a common error as before remarked both among writers and scholars.

The system of classifying events does not necessarily belong only to the second perusal of the text book, but might be brought into operation from the first, and continued through the whole course. But there will be more likelihood of an original and independent train of thought suggesting itself to a student who has previously acquainted himself with the leading events in their order of time. He is, therefore, recommended to read some short history of the great nations of antiquity, and of his own country, without attempting to classify his subject, but contenting himself with a mere chronological table.

Upon a second perusal of these books, or of others on the same subject, he will have a much clearer notion of the matter before him; and will be better prepared to form his own ideas, independently of those received from his author.

From this point the mechanical directions for reading will be discontinued, as the student who has pursued such a course through one or two volumes, will be quite capable of modifying it to suit his own views. His attention will now be called to some of the subjects which will probably attract his notice, in examining the three classes of events to which he is about to apply himself; premising, however, that the compass of this work will not allow of any thing beyond a few desultory remarks upon each branch of the subject.

In reference to military history, it is not to be expected that any thing beyond a short description of each battle can be obtained from elementary books. The plan of a campaign, the system of discipline, and the causes of success or failure, must be left to future reading, yet it is very desirable to follow the course of operations, at least so far as to know the locality where any battle or other movement of the kind took place. For this purpose a common atlas is a very useful companion, and history should never be read without keeping the maps in constant use. When time allows of the perusal of larger works, every thing relating to military operations will naturally claim attention, and the systems of discipline and tactics, the arms and the influence which the conduct of the home government exercised upon a conflict, will repay a close observation.

There is one point connected with military history, upon which information can be obtained, even from a compendium, namely, the proximate causes which lead to a war. Taking their root in human passions, which do not materially vary either with time or place, we might expect to find the quarrels of nations arising from similar

causes among all people, and differing so much in each, as to defy all attempts to fix upon them a national character. This expectation, however, is not borne out by historical facts. There appears to have been in every state some national tendency which displayed itself, as much in its wars as in other actions.

In commercial countries this was generally connected with trade. Such states have usually sought the extension of their power, rather by colonies than by arms; and it is curious to observe how widely their influence has sometimes extended in this form, compared with the narrow dominion which formed the nucleus of their power. Yet trading nations have been quite as prone to war as their neighbours; and their conflicts have been maintained with peculiar rancour and obstinacy, in defiance of all considerations of economy; but they have usually sprung from commercial jealousy, or from the necessity of protecting their commerce.

Among ancient nations, the Phœnicians and Carthagenians are the most remarkable examples. The former scarcely appear in History as principals in a war, though repeatedly figuring as allies, yet their colonial influence was spread through the whole known world. The latter may almost be said to begin and end their military history with the life of Hannibal and his father. In the middle ages, the Italian republics took up the trade of the world, rivalling their predecessors in commercial activity, and far exceeding them in combative rancour. Some of the most stubborn conflicts in European history are found among these states, who commenced the struggle without a hope of profit, and continued it to the utter prostration of both parties.

There were other states both in ancient and modern times who regarded trade and conquest with equal aversion, and devoted all their energies to self-government. They appear to have regarded a state of inactivity as the highest of national blessings, and seclusion as the

best means of securing it, forgetting that progress not decay is the tendency of society. Among these nations Sparta, China, and the East Indian peninsula present the most eminent examples; but though similar causes may perhaps have originated these tendencies, the consequences they produced differed as widely as the forms in which they were developed.

In some of the Eastern nations the institution of castes prevailed, and by limiting each man to the occupation of his father extinguished ambition in the breasts of a whole people, but by committing the defence of the state to one class, and making no provision for recruiting it, the balance of the community was destroyed; the peaceful castes increased without interruption, and with them the wealth, and therefore the danger of the nation; while the defenders, exposed to greater risks, dwindled more and more into the minority, till reduced to a fraction quite inadequate for the purposes of defence. Another evil of this custom was, that it removed all national pride and love of independence from the bulk of the population, and taught them to regard the military virtues as qualities in which they had no concern, preparing them to submit, without a struggle, to the first invader who could subdue their army. In all states in which the right of bearing arms was limited to a certain class, some of the same evils resulted, the extermination of the citizens being reduced to a question of time. The loss of men was regarded as the worst of all evils, as may be noticed in the address of Pericles to the Athenians, when advising them to forsake the open country; and in the humble tone assumed by the Spartan envoys when their forces were blockaded at Sphacteria.

There was a third class of nations whose sole aim and mission in the world was conquest. Among these, Rome occupies the first place, although Macedon, during her short career must not be omitted. The former people devoted themselves exclusively to war, and waged it with

a pertinacity unexampled in the annals of other nations. Their struggles were not more characterized by system and enterprise, than by perseverance and endurance. With them war assumed the form of a settled business, and was conducted with all the method and calculation with which other countries managed their commerce. In describing their system, we might advantageously borrow from the vocabulary of peace the word *industry*. On the other hand, we look in vain for those higher qualities which usually soften the ferocity of war. Sympathy with a brave enemy, generosity to the vanquished, or self-sacrificing enlistment on the weaker side, are not to be found in their annals. If they declared war, it was with the hope of gaining an advantage, and when gained, they had no disposition to renounce it upon sentimental grounds.

The destruction of Rome by the Gothic tribes commenced a new era in military history, in which a far less cultivated system was ennobled by the display of higher moral qualities. Truth, fidelity, and magnanimity were as much esteemed as courage, and a sincere though exaggerated religious zeal produced some of the most remarkable phenomena in the history of man. It would, however, be vain to seek for any distinct impress of national character in the wars of feudal nations. The causes of a struggle must be looked for in the breast of the sovereign, by whose will and for whose benefit they were undertaken. The nation at large, though enjoying a veto, was not sufficiently enlightened to exercise it upon public grounds, and was generally actuated solely by its feelings towards the King. The necessary result was that the advantage to be gained by the sovereign in the form of extended dominion, was pretty evident, while the interest of the nation was generally in no way concerned, even if it was not at variance with the success of its arms. As familiar examples of this, the desertion of King

John by his vassals, while endeavouring to protect his Norman dominions may be cited; and, on the other hand, the zealous co-operation of the nation in the wars of Henry the Fifth, by which, if successful, the island would have been reduced to the position of a province.

In general, however, the passion for arms which characterized those times, made it an easy matter to lead the nation into war. Indeed, it would be scarcely too much to say, that from the fall of Rome, till very recent times, all Europe was fighting from one extremity to the other. It would be useless to attempt to classify the causes which led to these struggles, as they were always the same, mere barefaced lust of dominion. Fortunately for the cause of population, the art of defence had gone very far beyond that of attack, and any thing in the shape of a wall was an almost insurmountable barrier, besides which the efficiency of the armour, and the inefficiency of the arms contributed to lessen the effusion of blood. The tactics of these times were too simple, and have been too much modified by the introduction of artillery to reward a close examination, yet there are points which, depending solely upon moral causes, are not affected by external changes, and such are deserving of attention whenever they occur.

As soon as the general use of fire-arms, and the adoption of standing armies had reduced the system of warfare to something like its present forms, the details of a campaign become of evident importance; but they cannot be advantageously studied in conjunction with general history. The materials for this branch of study are more plentiful in the French language than our own; but a sufficient number have been published in England to keep the most active reader engaged for several months. It cannot be necessary to employ argument with a military student in favour of this portion of his education; but in case he should at any time be called upon to defend this part of his studies from the arguments sometimes

used against it, it may be well to arm him with a few sentences in which the subject is defended with the usual truth and spirit of Dr. Arnold.

"A nation's external life then is displayed in its wars, and here history has been sufficiently busy; the wars of the human race have been recorded when every thing else has perished. Nor is this to be wondered at; for the external life of nations, as of individuals, is at once the most easily known, and the most generally interesting. Action in the common sense of the word is intelligible to every one; its effects are visible and sensible; in itself from its necessary connection with outward nature, it is often highly picturesque, while the qualities displayed in it are some of those which, by an irresistible instinct, we are most led to admire. Ability in the adaptation of means to ends, courage, endurance, and perseverance; the complete conquest over some of the most universal weaknesses of our nature; the victory over some of its most powerful temptations, these are qualities displayed in action, and particularly in war. And it is our deep sympathy with these qualities much more than any fondness for scenes of horror and blood, which has made descriptions of battles whether in poetry or history so generally attractive. He who can read these without interest, differs, I am inclined to think, from the mass of mankind, rather for the worse than for the better: he rather wants some noble qualities which other men have, than possesses some which other men want."

In connection with the military history of nations, some knowledge of biography will generally be acquired, upon which no comment will be made; but the civil history or records of constitutional settlements may require a few remarks.

These legislative changes are the real history of a nation: they are its own acts, and show more than any incident the state of society at the time to which they refer. Their effect is permanent, while that of a battle is

generally temporary; and they give us some idea of the progress of a nation, presenting its history as a connected chain of events. Moreover, the constitution of ancient nations affords a key to their ultimate fate, which would otherwise appear dependent on mere accident. By comparing the system of government in several cotemporary nations, we shall generally find sufficient to account for their final relative position. Let us, for this purpose, examine the internal state of the three great nations of antiquity,—Athens, Rome, and Sparta,—at the period when the two former had lately expelled their despotic rulers, and were striving to consolidate a republican form of government.

Athens was, indeed, far in advance of both her competitors in arts and civilization; but there were still many points of resemblance. All three were composed of a privileged body of citizens anxious to maintain the government in their own hands, and to keep down those who had not the franchise; and all were surrounded by states equal to themselves in power, and closely allied in race and language. But in the tendency of their laws they differed widely. Sparta was pledged irrevocably to her code of Lycurgus; and it has been shown how that code led of necessity, though slowly, to the extinction of her citizens, and the decay of her power.

It seems not improbable that the same causes which led to the establishment of this extraordinary code, had produced also the Eastern system of castes; namely, the jealousy of a conquering, but numerically feeble race. But in Sparta, the operation of those causes was counteracted by the character of the people themselves, of the subjects they were to govern, and of the surrounding states, and the effect was greatly altered by these powerful agents. The institutions of Eastern nations sat easily upon them, as if the natural exponent of their peculiar character of mind, and something of sympathy may be traced between the customs of the

nation, and those of the individual. The Spartans, on the contrary, seem to have *subdued* their natural disposition in obedience to an imperious policy forced upon them by their position. Ruling a people more numerous than themselves, and of the same nation, character, and language, their attitude was that of an army in an enemy's country. Suspicion and watchfulness were as necessary as discipline; and hence, probably, those strange and savage customs which seem to have had for their object the exasperation of both parties, rather than the intimidation of either. To avoid conflict with other nations, it was necessary to shun all intercourse; hence their enmity to commerce, and their iron money: nor does it seem improbable that had they been surrounded by less enterprizing neighbours, their customs might have degenerated into something analogous to the castes of the East. As it was, they were forced out of their exclusive customs by the restlessness of their neighbours, and by their own suspicions. Perpetual wars, negociations, and intrigues, acting upon an energetic people, moderated and ultimately destroyed the effect of their institutions; but too late to avert the extinction of their citizens, who had suffered by degrees the inevitable fate prepared for them by their lawgiver.

Not the least remarkable action of the Spartan laws was their influence upon the state as contrasted with their effect upon the subject. The individual was trained from infancy to despise suffering, to act with decision, and always to leave his body upon the scene of his defeat. The state was slow and timid, more careful of the lives of her children than their natural mother, and ready to gain her object by subtlety rather than force. The man was rarely moved by fear. The nation acknowledged no other incentive. She had no enterprise, and little ambition; jealousy of her subjects was the ruling motive of her internal action; fear of foreign aggression, the maxim of her external policy. In almost all negotiations with other

Greek states, we find the Spartans addressed not with promises of advantage, but with threats of danger.

Athens, on the other hand, tried the dangerous experiment of a pure democracy, with its usual concomitants, a rash and variable policy. But while the Athenian citizens enjoyed as much equality as difference of property would allow, they were anxious to preserve their ranks from the intrusion of the unprivileged orders. Hence the fate of the Athenian, like that of the Spartan, would have been extinction, if they had been bound by the same rigorous laws; as it was, the admission of new citizens took place in an abrupt and irregular manner under the pressure of necessity, and in such numbers, that instead of assimilating to the old citizens, and taking their cue from them, they carried them in their own course, and produced those violent changes for which the history of Athens is remarkable.

Turning from the Greek states to Rome, we there find the relations of patron and client, which were probably designed to mark as strongly as possible the line between the classes, producing an effect diametrically opposite, by calling into existence a new class—the plebeians, whose ranks were replenished from so many sources as ultimately to overwhelm the citizens. The necessity of enlisting this powerful and increasing body in the defence of the state, led to the creation of the order of knights, an efficient link between the rival bodies; and, finally, the secession of the plebs at a time when neither party was strong enough to demand violent concessions, broke the monopoly of the patricians without overthrowing the balance of the state. From this period, we may trace the regular rise of the plebeian power till it became the acknowledged source of all legislation; and at the same time we may notice the gradual absorption or extinction of the original citizens.

This was the true revolution of Rome, but it operated slowly through a long interval, and with that indirect and

secondary influence which seems to be the only safe method of acting upon the constitution of a state. As all foreigners who resided at Rome, as well as the population of conquered cities swelled the plebeian muster rolls, and these became by degrees the ruling power, there was a provision for the perpetual recruiting of the body of citizens. The state had acquired a power of assimilation by which it transformed all foreign ingredients into a portion of itself. It carried the same power even to its most distant members. The provinces by the aid of the municipal system were formed into a succession of grades, all looking up to Rome as to a head, all enjoying some privileges, and hoping for more; while a certain number of the municipals were yearly drafted by a regular system into the rank and privileges of Romans. Thus a newly conquered territory was taught to fix its hope, not on the recovery of freedom, but on the reward of fidelity; and to this system we may trace the remarkable fact that no province once held by Rome was ever wrested from her hand. The original citizens died out with their descendants, and their successors, once plebeians, shared the same fate; yet the state never felt their loss; as these particles of the old body disappeared, their place was supplied by the new blood continually formed from other materials, and Rome preserved her identity, though perpetually changing her elements.

In reading the history of Rome, therefore, we must not expect that absolute national identity which we find in England or in Greece. The subjects of Romulus, if we admit his existence, were not the ancestors of the subjects of Augustus. Foreign ingredients, either as slaves or settlers, had diluted the old stock, till scarcely a trace of its former composition was visible; yet the mixture had taken place little by little, so that each contingent being for the time a minority, had been absorbed into the bulk of the nation without affecting its nationality. Thus the history of Rome is not so much the annals

of a nation as the record of a system of government founded indeed by the people whose name it bears, but endowed with the property of turning all that it touched into Romans.

In the general confusion which followed the downfall of the Western Empire, only one method of government presents itself in a definite form, that is the feudal system. In its principles it was the same throughout Europe, and those who understand the constitution of their own country during the middle ages, will have little difficulty with that of other states. In England, the form which this system assumed under the Saxons, and its transition into that of the Normans are the features most worth considering, together with its destruction in the wars of the roses, and the consequent despotism of the Tudors. The civil wars extinguished the despotic power of the Crown, restoring liberty to the subject, not in its feudal but its Saxon form; and in the subsequent reigns the last traces of feudal power passed into oblivion.

The great measures by which these changes were achieved are an essential part of the history of the nation, and should at no time be neglected; but the minor details must be postponed to a later period. In the course of reading, which now lies before the student, it would be impossible for a work of this character to accompany him far, nor is it necessary, as the lectures of Smythe and Arnold form an admirable guide to the subject. A few hints for the use of those who may not intend to follow the extended course laid down by those authors will close the present chapter.

Upon laying aside his text book, the student should still select such works as compress the whole subject within a reasonable compass, and avoid those discussions on abstruse points with which larger treatises are apt to be encumbered, and which rather puzzle than enlighten the beginner. He will, however, be obliged resolutely to withstand the temptation to which this class of reading is

peculiarly liable, namely, that of being carried away by the interest of his story. A history, well written, yields to few works of fiction in this kind of excitement, and it requires considerable care to guard against a tendency to slip over dry passages in favour of those which carry on the tale. Great benefit may sometimes be found from reading two or even more books at once, for the object being to learn what happened at a particular time, and not what an individual author has said about it, the point is more likely to be attained by comparing two writers at once, than by reading them in succession. Much time also is saved by such means, as the second or subsidiary work need only be glanced through sufficiently to notice parts where it differs from, or enlarges upon, the text book. The headings of the chapters and the marginal notes, if there be any, may be made useful; nor should a chapter ever be quitted without reading through the heading slowly and thoughtfully, or even glancing through the pages sufficiently to recall to memory the facts which have been related.

In reading the more copious histories, the student will often find the bulk of the work composed of discussions on subjects which at present he cannot even understand, or on nice points of evidence which are foreign to his purpose. But in rejecting such passages, he must carefully guard against a tendency to pass over every thing that looks a little dry, for by such a practice he will denude his subject of all its intellectual character, and reduce it to a barren effort of memory. It will require some judgment to make this selection, and the tendency should always be towards reading, not skipping; but the student should bear in mind that his object at present is to ascertain what is *received* as history, and that he is not capable at present of judging what *is* history. All mere controversy, therefore, may be passed over, or rather postponed, as it will be sufficient to know what opinions are held on either side, without enquiring very closely into their grounds. Again,

a dissertation of some pages upon an unimportant or doubtful fact should be omitted, while events, permanent in their effect, and of accepted authenticity, should be carefully examined. In this way the many doubts and disputes about the Trojan war or the origin of the Gothic tribes may be left for more advanced students, but the code of Lycurgus and the feudal law are essential as keys to their several histories. The reader, therefore, must exercise a discretion in perusing or rejecting, and the fixed attention necessary to do this will prevent his study from degenerating into an indolent skimming of the books in search of amusement. Those who propose to acquire something beyond a conversational acquaintance with the subject, should consult, in the first place, the lectures of Arnold and Smythe, as even where the course those authors recommend could not be followed, the intrinsic merit of their works will reward their perusal by the suggestion of liberal and enlarged ideas.

Chap. III.—GEOGRAPHY.

DIVISION OF THE SUBJECT—METHOD OF INSTRUCTION—ON COLOURING OUTLINE MAPS—STUDY OF THE CONTINENTS AND OCEANIC ISLANDS—PHYSICAL AND ASTRONOMICAL GEOGRAPHY—CHARTOGRAPHY—MILITARY GEOGRAPHY—EMBOSSED MAPS—MEANS OF REPRESENTING VERTICAL AND HORIZONTAL DIMENSIONS.

THIS subject has been commonly divided into two branches, physical and political, to which some add a third, under the name of mathematical geography. The first division has only of late years being formed into a distinct science, but like all branches of knowledge which have come into existence in this peaceful and active century, it has made a prodigious advance, and already displays a growth and symmetry out of all proportion to its years.

The facts which properly belong to physical geography are the horizontal conformation of the earth's surface, as continents, islands, seas, and rivers; and its vertical structure—mountains, table lands, and plains. The formation of these features, such as their geological strata, their chemical character, and every peculiarity which is purely natural, together with their animal and vegetable products, are included in this capacious subject, which thus embraces almost all the sciences with which man is acquainted. Political geography regards the earth's surface only in its character as the residence of the human race taking cognizance of the districts inhabited by different tribes or communities of men, and styled nations, within which it also observes minor divisions, such as provinces or cities. In its strict sense this subject would exclude all but political or artificial limits; would take no note of vertical dimensions, and would regard seas, rivers, and mountains only as they affected national boundaries.

Neither branch can be studied exactly as it is here laid

down, the one would be too contracted, the other too diffuse; but taken conjointly, they will mutually aid each other, and after some progress has been made, either department may be carried on alone at pleasure.

According to the old method of learning geography, the memory was the only faculty called into play; the little books in use at school were learned by heart, with only an occasional reference to the atlas, but the general introduction and use of maps has, in a great measure, superseded this custom with great advantage to the learner. When it is considered that geography is entirely a question of figure and position, it will be allowed that it appeals more directly to the eye than to any other faculty; and it follows, that the eye should be cultivated, as it would be in any of the arts of design. This is the more desirable from the fact, that every image to which the eye has once become accustomed is retained, by some power for which we have no name, and can be conjured up at will without any conscious use of the memory. This power which all possess and exercise daily upon the objects around them, may be made of great service in acquiring knowledge of geography. The plan, therefore, which it is proposed to adopt, will supersede, as much as possible, the voluntary effort of the memory, and replace it by a map engraven in the head, and always ready for consultation.

It is evident that an atlas will be an indispensable companion, and a good outline map of each of the four divisions of the globe should be obtained, selecting those which have all the rivers, boundaries of states and cities, and if possible, the mountains. Bearing in mind that it is an object to present a striking and distinct picture to the eye, we should proceed to throw up the outline of the land by tracing it round with a narrow band of pale black or Indigo. The shape of the continent will then be very visible, and the process of learning will already have begun before the map is finished. With the assistance of the atlas, let the space occupied by each

nation be covered with a flat shade of any convenient colour, observing that two contiguous states should never be of the same tint. The places of the principal cities may be marked with a small ring of red, or any other conspicuous colour; and the rivers, if too faint in the original map, may be traced out with a pen dipped in Indian ink. The map will then be ready for use.

It may be observed, that as the object in preparing this plan is to address the eye, not the understanding, everything should be as obvious as possible. The sea line should be darker than that used in common maps, the surface of the countries about the same, and the cities or towns should be as distinct and bright as possible. The preparation of one of these maps will occupy about two hours. The mode of using them is as follows:

Beginning at the North, and passing regularly round the coast, let the names of the principal oceans, seas, gulfs, and straits, be learnt by means of the atlas, repeating them several times through with the blank map alone. The islands, capes, and peninsulas, may then be taken in the same order, by which time the eye even of the most inexperienced, will have become familiar with the shape of the continent in its general outline, and will be prepared to examine its internal construction. Rivers and mountains will naturally occupy the next place. The former should be traced from the source to the mouth every time they are named, and their directions and curvatures noticed with great care. All the chief tributaries of any large river, should be studied in the same manner; and some pains taken to remember the point at which they effect their junction with the main stream.

In learning the localities of cities, it will not at first be desirable to acquire more than three or four in each state, as in this part of the work, the memory is employed much more than in others, and there is danger of overburdening it; the number may afterwards be increased to any required extent.

When this quick survey has been carried through the four great continents, a map of each hemisphere should be obtained, or the world upon Mercator's projection, for the purpose of studying the islands of the Pacific, as well as Australia and New Zealand, which are not always found in maps of the continents. In this part of the course, it is especially necessary to consult a book upon geography, as there will otherwise be great danger of omitting some of the islands. It is desirable to choose a work that has been recently published, or revised, but most of those in common use will be sufficient, without such aid a beginner will most probably pass over some places, such as the Bermudas, Mauritius, and others, which derive their importance from causes distinct from their size.

It will now be time to bring the knowledge of physical geography up to about the same point as the political, as these subjects assist each other, and the former, from its more picturesque character, relieves the dryness which a multiplicity of names communicates to the latter. It will not at present be necessary to study any of the sciences connected with physical geography, such as geology, chemistry, or botany; but merely to establish some acquaintance with those phenomena which can be understood without previous training; such as the great ocean currents, the monsoons and trade winds, the elevation of the land, whether plain, valley, or table land, the position and direction of the watersheds, and other points connected with the general contour of land.

Within a very few years, and perhaps within the memory of most of my readers, this kind of information could only have been acquired by an extended course of general reading. The materials had indeed been obtained and published, but they had never been collected, and were consequently out of the reach of the general student. The honor of introducing the new science in a compact form to the English scholar belongs to Mrs.

Somerville, whose work on physical geography will long retain its place among the most readable of scientific treatises*. The impulse given by this work has been followed up with great spirit; books of all sizes, and of all degrees of merit have been laid before the public, together with atlasses, so complete and elegant, as to belong rather to the maturity than the infancy of a science. To some of these works it was originally my intention to refer; but in the meanwhile a treatise has been published which is likely to supersede all that have hitherto appeared, it is entitled *A Manual of Geographical Science*, and has been drawn up by a party of authors, each eminent in the department he has undertaken; it gives, within a reasonable compass, an extent and variety of information, which, before its publication, could scarcely have been obtained even by very diligent readers; and as it does not require a mathematical education, but is on the whole as popular as the nature of the subject permits, it may conveniently be adopted as a book of general reference.

The student should endeavour to acquire some familiarity, not only with the facts submitted to his notice in any treatise on geography, but also with the means by which those results were obtained, and the medium through which they are usually conveyed. For want of this kind of information, a great portion even of the educated public remains in contented unconsciousness of some of the greatest efforts ever made by the mind of man; and which in many cases are the more worthy of notice, that the first giant idea was born into the world, in what is termed the infancy of society. It was by no common effort of intellectual daring, that man first at-

* It is but just to state, that the popular work, entitled *Recreations in Physical Geography, or, the Earth as it is;* by Rosina M. Zornlin, was first published in 1840, several years before the appearance of Mrs. Somerville's treatise on the same subject.—*Note by Publisher.*

tempted to gauge the orb upon which his feet were placed; or to break through the consciousness of his own world, and recognize its subordinate station in the universe beyond. These great original steps in physical science are within the reach of a schoolboy, if he will take the trouble to seek them; and when considered in relation to the primitive times in which they were made, they serve as a corrective to the overweening opinion of the present day, which an age so brilliant is apt to generate.

A knowledge of geographical and astronomical instruments is an essential portion of the history of the sciences, for they have advanced together, and speculation has often been compelled to halt for the lagging steps of mechanical improvement. Had Pythagoras possessed the instruments which we now enjoy, he would probably have fixed his bold speculation upon the sure basis of observation, and anticipated the settlement of the problem of the universe by more than twenty centuries. Nay, when the great principle of gravitation dawned upon the world of science, its confirmation was delayed by the contradiction of certain inaccurate observations; and Sir Isaac Newton concealed and laid aside so effectually his seemingly exploded theory, that, but for the timely correction of the general error, his discovery might have perished with him. It may indeed be doubted, whether the mechanical imperfection of instruments has not been the chief hindrance to the progress of astronomy, or rather the cause of its retrograde tendency during that long sleep of two thousand years. A false system of philosophy supported by ignorance and bigotry might have clogged its movements; but in the cause of science based upon facts, there have seldom been wanting clear heads and strong spirits who could break through the one and defy the other. The speculative truths enunciated by the fathers of philosophy were choked in the verbiage of their followers; the rudest observations of the telescope survived the persecution of Galileo.

But if it be admitted that the use and history of instruments is an important companion of popular astronomy, it will be difficult to excuse their neglect, since they are by far the easiest branches of the subject. The sort of acquaintance which has been possessed by many men whose observations have done good service to the science, may be acquired in a few hours' reading, and will help to elucidate and explain every portion of the system.

It was said that the *medium* in which geographical information is conveyed, should have some especial attention; it requires but little, yet that little it very rarely receives. Every child in its first year at school learns something of the uses of a map, and knows that it pretends to represent on a flat plane the rounded surface of the globe; yet very few, when they leave school, or even college, have any notion of the principles upon which that transfer is made. To take one example:—how common is the impression that detached portions of the globe are depicted on the same principles as the hemispheres; and that if the continent of Europe for instance were enlarged from the scale employed in the hemisphere to that of the separate map, the two would exactly correspond. Nothing, however, can be further from the fact. The method employed to depict the spherical surface in small portions of the globe is essentially different from that adopted for the hemisphere, and in both an approximation to the truth is all that can be attempted. This branch of the subject is well worth the attention of every reader, and it is explained with great clearness and precision in the work already recommended.

When some outline of physical geography has been acquired, and a few hours employed in the study of chartography and the use of instruments, the student should re-examine his outline maps, and prepare them for a more extended course. He has hitherto inserted only a few of the principal cities; he should now

introduce all that have any pretension to political or historical importance, remembering that towns and districts have an importance in the eye of the student quite independent of their present condition. He should also mark out the provinces of most of the continental kingdoms, without a knowledge of which, his historical reading must always be inaccurate. There may be some difficulty at first in deciding what towns to insert, and what to omit, as not many books can be trusted as guides in making the choice. It is not from population or commerce alone that a town takes its rank in the view of a student, historical associations bringing many places into notice which at present are of little importance; nor is it safe to trust, as is too often done, to the name being printed in capitals, in an atlas: a better plan will be to insert all cities whose names are familiar to the ear, as these must either have been met with in reading, or been commonly referred to in conversation. In reference to provincial divisions, the separation of the kingdom of France, into departments and provinces threatens the learner with a double task. The former are now in use, and would, therefore, be essential to an understanding of any recent transactions; but history treats always of the latter, and they are, for that reason, indispensable to all who wish to understand what they read. If both cannot be learned, the departments can, perhaps, be spared more easily than the provinces.

In correcting and extending the map of Europe, the military geography lately published by Colonel Jackson, from the text of Lavallée, will be of great service, and should be always at hand. It gives the closest topographical description of every part of the continent, especially with relation to military affairs; and from the character of its author and editor, may be relied upon as one of the most accurate works on geography that has yet been published. With the aid of this treatise, the

principal fords of all the great rivers may be put in, and the chief passes through the mountain chains. It would be convenient, also, to mark the point at which the former cease to be navigable for shipping.

While thus revising the maps, some larger work upon physical geography should be read, such as that by Mrs. Somerville, which is sound as well as popular. Some of the chapters in Lyell's *Geology* will be found full of instruction, without carrying their reader too deep into a science which he may not at present have time to undertake. The necessity of acquiring some knowledge of each country beyond that which can be obtained from a common atlas, will be evident when it is considered how great an influence vertical dimensions, and other causes which cannot there be represented, exercise upon climate and productions. The impression on this subject, which most young people bring with them from school is, that latitude is the only regulator of heat; and that all places upon the same parallel, will have a nearly equal climate. How far this is from being the case, will readily be seen by consulting a map of physical geography. The isothermal lines drawn through places possessing equal mean temperature, will be found to pass over many degrees of latitude. Thus, the same average heat prevails in the North of Newfoundland which has about the same latitude as London, in the North of Iceland, at North Cape in Norway, and at Archangel, an interval of about twenty degrees, or equal to that which separates London from the Northern portion of the Great Sahara. This prodigious variation in the position of the same temperature, is occasioned by causes quite independent of altitude; but if we take this element into consideration, we shall find it exercising an influence equally important.

An elevation of 350 feet produces the same alteration in the temperature as a degree of latitude, a very moderate altitude, therefore, will display a great difference in climate; nor must it be imagined that the operation of

this cause is confined to a few small villages situated on the mountain slopes. Vast table-lands, occupying considerable portions of their several continents, are to be found both in the old and new world, and some of these at great elevations. The most remarkable is the plateau of Thibet, which covers a wide space in central Asia, at a mean altitude of 12,000 feet, or more than three-fourths the height of Mont Blanc, and from that declines by a gradual slope to the North coast of Siberia. In this plain is situated the city of Lassa, at an elevation of 10,000 feet, or nearly two-thirds the height of Mont Blanc. If we compare this city with any other in the same parallel, but on the level of the sea, and calculate the mean temperature of Lassa by the rule just mentioned, we should expect a difference of mean annual heat, similar to that which would be produced by twenty-nine degrees of latitude; or referring to our former illustration by the distance between St. Petersburg and the great desert of Africa.

It will be evident from these instances, that something more than an acquaintance with horizontal position and dimensions will be required, before the student can satisfy himself that he has an adequate knowledge of the surface of the globe. Neither an atlas nor a book on geography of the common kind will fill up the deficiency, but new works are continually publishing, and some of these may, perhaps, give him all the information he requires.

Some of the more recent maps have a profile to correspond with each plan, a most useful addition of which, all who wish to understand the subject should avail themselves. Embossed maps have also been lately introduced; but they labour under a defect, which it may be doubted whether any ingenuity can remedy. If the vertical and horizontal dimensions are on the same scale, the former will be quite imperceptible, except as a small point to represent the highest mountains. If, on the other hand, the vertical dimensions be greatly magnified, they

diminish by comparison the horizontal extension. Thus, the mountains assume the form of peaks, and an impression, which has already been generally, but most erroneously formed, is confirmed. Let us see how this system would act in giving a true impression of the Plateau of Thibet, to which reference has already been made. If the true proportions were preserved, the plain would indeed appear of its true extent; but on the scale of Mr. Wylde's great globe, it would only rise about the fifth part of an inch, and when it is added, that on some sides it would terminate in a chain of mountains rising above it, and on others would slope gradually through a very large space, never showing a perpendicular edge, it is evident that its presence on an ordinary map would be imperceptible. On the other hand, if the vertical scale be exaggerated, the surface of the table-land will of course appear much too small; and one of its most remarkable features, vast horizontal extent, will be lost sight of, but the height will still appear very insignificant, being brought into close comparison with the lofty peaks of the Himalayas.

From these considerations, it may be doubted whether embossed maps are a desirable alteration, at least for general use. For occasional reference, there can be little doubt of their utility; but to acquire any thing like a competent knowledge of the earth's contour, there is no criterion equal to numbers. The eye, which is every thing in horizontal dimensions, is of little use in this, being incapable of appreciating slight elevations; but when reduced to figures, the mind can estimate and compare every difference. It is not absolutely necessary to adhere to the system of measurement hitherto employed in maps. The measurement of altitudes by feet, and of surfaces by square miles, is convenient for those who require accuracy, but it conveys no definite idea to the mind, as we are unable to conceive thoroughly a very large number; if, however, we reduce the number by increasing the unit, we bring it at once within our comprehension.

To illustrate this plan, let us return to the altitude and extent of the plateaux of Asia. They were said to rise to the height of 12,000 feet, which left on the mind only a very vague impression, but if we increase the unit to a mile, and describe them as 2¼ miles in perpendicular altitude, we obtain at once a definite and adequate notion of their height. In the same manner, when it is related that the whole plain of Chinese Tartary, of which Thibet forms a part, covers a space of 2,808,000 square miles, we are, for the most part, quite unable to realize its magnitude, which, however, becomes evident when it is described as nearly forty-two times the size of Great Britain, and larger than all Europe. In all compact spaces, such as the country just mentioned, it is perhaps more convenient to retain an idea of the length and breadth, as our notions are always exceedingly vague with regard to superfice, but it is necessary to record the superficial extent in books for the sake of those states which have an irregular figure.

I shall close this chapter with a strong recommendation to the reader, not to refuse himself the pleasure of reading some good treatise upon Physical Geography. If he has worked his way through the dry routine of cities, nations, and provinces, which form the main features of political geography, he has certainly earned some relaxation, and it could not come in a more appropriate form. In that science he will gratify that love of mystery which all men possess, by the contemplation of secrets more profound than any that were hidden at Eleusis; there too he will hear of wonders that might have added one more to the thousand and one nights; and more valuable than either, may, without labour, store up food for reflection, sufficient to last the longest life, without danger of exhausting its novelty.

Chap. IV.—MATHEMATICS.

IMPORTANCE OF A THOROUGH KNOWLEDGE OF THE ELEMENTS—MECHANICAL ILLUSTRATIONS—DECIMALS—INTERVAL BETWEEN ARITHMETIC AND ALGEBRA—MATHEMATICAL LANGUAGE—ALGEBRAIC ADDITION, SUBTRACTION, &c.—QUADRATIC EQUATIONS—GEOMETRY—TRIGONOMETRY—APPROXIMATE RESULTS—CONIC SECTIONS—STATICS—DYNAMICS—DIFFERENTIAL AND INTEGRAL CALCULUS—CONCLUDING REMARKS.

THE first step usually taken in this science is Arithmetic: it is not absolutely necessary for the investigation of either algebraic or geometric principles, but it prepares the mind to receive the more abstract branch, and is therefore commonly adopted as *the element*. As far as fractions and decimals, this subject has usually been acquired at school; but to avoid the loss of time occasioned by an imperfect knowledge of the elements, when the mind is occupied with the higher subjects, it would be well to revise all the early rules before advancing beyond fractions.

The points which should especially engage attention are, long division, compound and simple multiplication, by composite numbers, and reduction. Proportion may be postponed till some knowledge of fractions has been acquired. There is little to remark upon these early rules, except that slowness and uncertainty in their application, are a serious hindrance, and that great readiness may be acquired in a few weeks by ten minutes' daily practice.

In the rules which usually precede fractions, it is not necessary to understand the reasons for every step, as the learner would thus be detained an unnecessary period among the rudiments. The rules which are found in books may be taken on faith, and their truth will become evident on further progress. As soon, however, as the student has commenced vulgar fractions,

he should make up his mind to understand every principle. There is nothing in that subject, or those which follow, which is really above his comprehension; and if great difficulty is found in any step, it arises from inability to fix the thoughts upon the question. In the first place it is necessary to understand clearly what kind of magnitude is intended to be represented by the expression termed a fraction; and what duties are discharged by the separate parts called the numerator and denominator. The effect produced upon the whole quantity by operating upon these figures, whether by multiplication or division, may be considered the key of vulgar fractions. Those who have made that principle their own, will not find much difficulty beyond, while without its aid nothing which follows can be really intelligible.

Owing to the technical language necessarily employed in mathematical works, the explanations are not always obvious to beginners without some practical illustration, but the difficulty may often be removed by exemplifying the principle under consideration with the aid of some common object. Thus, if it be desired to examine the nature and parts of a fraction, let a sheet of paper, or any other convenient substance be selected as the unit or quantity represented by the figure one. Let this be cut into four equal parts; each of those portions is then called a fourth, and the idea of fourth parts is conveyed in writing by placing the figure 4 beneath a line. Such an expression then as a denominator without a numerator describes no part or quantity of the paper, but merely the fact that the sheet has been cut into four parts, in the same way as the symbol £ does not describe any quantity of money, but stands ready to fix the kind of coin to which a figure joined with it refers. If we now put in another figure as 3, we fix the quantity as well as the quality of each; and the expression $\frac{3}{4}$ becomes as definite as £3, while we observe that the figure 4 and the letter £ discharge the same function, namely, that of fixing what kind of object we

are describing. The denominator is so purely descriptive in its property, that we might dispense with it and substitute a word as in the expression 3 fourths. This or any other mechanical method of illustrating this class of quantities, may, perhaps, assist in establishing some process of reasoning, by which the principles of fractions may be understood. Each mind has its own peculiar burdens, and those who can see through the nature of fractions at the first glance, must not despise the difficulties of others to whom they may have proved an obstacle.

The necessity of understanding every step in this subject, cannot be too strongly impressed upon the student. It is sometimes a temptation, especially to the indolent, to find the rule very short and simple, the explanation very long; but any who try the easier route, will find the difficulty postponed, but not escaped. Some principle, depending upon that which has been missed, will, before long, present itself, and the very same obstacle will have to be surmounted, aggravated by the accumulation of fresh matter. Happy for the student if he does not a second time evade it.

From vulgar fractions it is usual to pass on to decimals; in conjunction with which, some steps, may be taken in algebra and Euclid; but unless there is great necessity for haste, it is advisable, in the first place, to establish a good acquaintance with the first subject.

The chief point to be observed in decimals, is the close analogy which they present to the common system of notation. The first idea conceived in numbers must have been that of a single, entire object; but as soon as that had extended to the congregation of several together, the notion of dividing one into many parts would naturally suggest itself. If then it was resolved to describe ten complete things by placing a symbol in the first place to the left, it would follow, that tenth parts or quantities ten times less than one should be expressed by the same symbol in the first place to the right. The

notation employed is therefore simply an extension of that used in integers, a point which should be thoroughly understood, as well as the multiplication and division of quantities, by transposing the decimal point. The effect of introducing a cipher, and the reason why it should alter the decimal figures when on their left, and the integral when on their right, should be carefully considered. It may be taken for granted that the knowledge of the subject is defective unless these facts appear, not arbitrary or exceptional, but the natural carrying out of the rule by which integral numbers are expressed.

The interval between arithmetic and algebra is the widest that occurs in the physical sciences, although they are often treated as similar subjects. Hitherto every principle has been established by reference to those real objects with which we are surrounded; and when a difficulty occurred, it has usually been surmounted by setting aside all general ideas, and applying the case as closely as possible to some particular instance. In algebra, all ideas must be general. The facts put forth are declared to be of universal application; and it is useless to attempt verifying them by particular instances. It is therefore necessary to train the mind to reason generally, without trying to satisfy its doubts by experiment. It is not indeed intended positively to interdict the occasional reference to a particular example, at the beginning of this new subject; such a process will sometimes be useful, for obtaining a fuller insight into the meaning of a proposition, but while employing it, the student should always bear in mind that the principle is true or false on general grounds; it may be illustrated, but cannot be confirmed by an example. He should, therefore, endeavour to wean his mind by degrees from the delight in concrete figures, and teach it rather to satisfy itself in those abstract symbols which embrace all quantities from zero to infinity.

While in this part of the subject, it would be well to acquire a clear notion of the mathematical meaning of

the word infinity; and of the distinction between the words infinite and indefinite. The effect of introducing the symbol by which the former is represented into any quantity, is well worth noticing, whether it appears in the numerator or denominator of a fraction, or as one of several factors. At the same time, that fruitful source of error, zero or naught may be traced through each of the same positions, as well as in its equivocal function $\frac{0}{0}$.

A most serious and mischievous mistake is frequently made by beginners in the neglect of the mathematical language. This dialect was invented to supply that which was felt to be an imperious want, exact terms to express exact ideas, it has, therefore, grown up step by step with the science, and is now of all technical languages the most accurate and elegant. It was not intended to increase but to diminish the difficulties, by applying a fixed name to each mathematical idea, as soon as it was born in the student's mind, and thus avoiding the use of intricate phrases; without it the science could never have attained its present dimensions. Those students, therefore, who attempt to dispense with the technical terms, place an insurmountable barrier in their own way, as they deprive themselves at once of the benefit of all explanations conveyed in the usual terms of art. It would be of great advantage to all beginners, if they would occasionally go back to the chapter of definitions, and satisfy themselves that they have a clear notion of every term. On commencing algebra, these definitions should be revised daily, until they become perfectly familiar; they give much more trouble at the beginning of a new subject than afterwards, a considerable number being necessarily accumulated at the commencement, while in the latter portion the fresh names occur one by one, and are easily mastered in detail.

One of the earliest of the definitions, and certainly one of the most important is that of the index or exponent. No time or trouble is misspent which is devoted to this symbol, the corner stone as it may be considered of

algebra. It is not uncommonly defined in a manner which leads to continual error, thus, if asked what a^5 meant, many learners would answer, "a multiplied by itself five times," whereas, this last process would produce a^6. To prevent such mistakes, it would be better to forsake that mode of definition, and describe it as *the product of five a's multiplied together.* The index should be studied in all its forms, including the negative and fractional, and when it vanishes. The student who cannot explain how each form arises, from the original conception of an index, may assure himself that his knowledge of the subject is imperfect.

The chapter of definitions if rightly understood, will have removed all difficulty from the four simple rules; but it would be assuming too much to hope that all who commence the examples in addition, possess any such knowledge of the preceding pages. They may indeed have understood each separate explanation as they advanced, and may retain it pretty accurately in their memory, but it is not yet become a part of their own reason, to be recalled without effort like other ideas with which they have long been familiar. To wait for this process of assimilation, would consume more time than can be spared, yet to carry crude notions into the more complex forms even of the early rules, would involve so many efforts of memory and understanding at the same moment as to task the clearest head. If it be attempted, it will end in a mere working by rule, which will baffle all future attempts to employ the understanding. The remedy is found in the methodical arrangement adopted in all mathematical books, by which easy and simple quantities are presented first, and if these be thoroughly mastered at the time, the later definitions will come into use one by one, and will present no considerable difficulty. If, on the other hand, the pupil should be tempted to evade the use of the first definitions which he meets in practice, and should allow them to accumulate behind

should be examined and applied. In equation problems the student will perceive, perhaps for the first time, the real nature and advantages of algebra, and will derive great benefit from the exact and analytical method of reasoning which he is now obliged to adopt. They will present considerable difficulty at first, but after a time will be found sufficiently easy, and by continued practice their solution becomes almost mechanical. From these the student should pass on to the two progressions which should not occupy more than two or three days; the binomial theorem may follow; and then trigonometry, which is more likely to be useful to a military man than the higher branches of algebra. But before entering upon this subject, it will be necessary to read six books of Euclid and a few directions upon the mode of doing so may be useful.

Not much can be done towards removing the difficulties from the path of the student of geometry. At an early period of its history, it was decided to be without a royal road, and we may question whether science would not rather loose than gain by the discovery of such a track. The difficulties so often complained of are not in the book, but in the scholar. The propositions consist of a series of deductions from known data, none of which are in themselves difficult, or beyond the reach of a common understanding, but as they accumulate, the mind becomes bewildered, and is apt to wander, when all that was done before has to be repeated. A continued and prolonged effort therefore is necessary, which must endure from the beginning to the end of the proposition, and it is the necessity of this tension of the mind, which has given to geometry its high character, as a mental discipline.

A proposition may be separated into three parts; first, the enunciation in which the fact to be proved is clearly though sometimes wordily stated; secondly, the application which applies the enunciation to a particular figure; and,

thirdly, the demonstration which proves the truth of what was stated. Between these last the construction is found, which may be described as an alteration sometimes made in the figure to facilitate the proof.

The proposition also divides itself into the hypothesis, and the theorem. Since the fact stated is not intended to apply to all figures, but is limited to a particular class, it is necessary to express this limit very distinctly; the expression which does so is called the hypothesis, the truth which is to be proved is termed the theorem.

Sometimes the enunciation begins with the word *if*, in which case the hypothsise is seen at once, being the conditional clause of the sentence. Sometimes it is implied in one word as in the following: "The three angles of a triangle taken together are equal to two right angles," where the word triangle contains the hypothesis, the proposition being only limited to triangles as distinguished from squares or other figures. Some propositions have a still more general application, as "all the interior angles of any rectilenial figure, &c.," where the hypothesis is implied by the words "rectilenial figure," and includes all kinds of figures contained by straight lines. It is worth while to notice these divisions, especially at first, as they serve to break up the proposition, and give momentary rest; but when the demonstration is once commenced, it must not be discontinued till the whole proof is completed.

The easiest method of learning a proposition, is to get the enunciation by heart, comparing it step by step with the figure, and separating distinctly the hypothesis from the theorem. In this task, the application will be found of great service; few would be able to comprehend the more intricate propositions without its aid; but with it, any person, not absolutely deficient, can accomplish the subject. After applying the enunciation to the figure given in the book, it is well to draw another, differing as much as possible from the former, and to trace the

application to this new case: when this can be done, the demonstration will be very much simplified, for, as before mentioned, the difficulty lies rather in the accumulation, than in the magnitude of the obstacles. The enunciations should be kept up from day to day, as they are constantly referred to; and the facility with which a new proposition is learnt, will depend upon familiarity with those which preceded.

Having read four books of Euclid, the fifth may be omitted, being more difficult and less useful than any other. The definition of proportion may be assumed, and the propositions superseded by algrebraic processes. The sixth book will then give very little trouble, only a portion of it being necessary for the ensuing subjects.

At this point of his course, the student should commence trigonometry, which will introduce him to a new system of investigation, namely, the combination of geometrical with algebraic reasoning. The first steps in this subject will to some appear rather difficult and perplexing, but the obstacles are quickly surmounted, and it will then generally be found easier than either of the preceding. It begins with establishing certain functions, the ratios between the sides of a right angled triangle, which cannot receive too much attention; they should be practised till all are perfectly familiar. After this, the chief difficulty will be in remembering the formula, for it must be observed that the results obtained in this science, are not expressed in words like those in geometry, but by an equation, to which the name of a formula is given. These expressions are not at first easily retained, but they are quite as necessary as the enunciations in Euclid, which indeed they represent; they must, therefore, be committed to memory at whatever cost of time and pains. It is better to do so by remembering the process by which they were proved, than by an exertion of memory alone, as on the former plan they are more likely to be recalled after a lapse of time; but whatever the means, the end

must be attained thoroughly, or before long, the reader will find himself at fault in the middle of some demonstration, having forgotten the formula upon which it depends.

Trigonometry being essentially a practical science to the soldier, it should be studied practically as well as theoretically. A number of examples should be solved in each chapter, before reading that which follows, and at the conclusion of the book, as many problems should be worked as time will permit. By such practice, the formularies will become familiar, and the principles will be so engraven on the student's mind, that their application on the ground will present no difficulty.

As the calculations in this subject are made by means of logarithms, decimals, and series, which give only approximate results, it may be well to explain the grounds upon which they are admitted into an exact science, a point which is not always evident to the beginner. Although a perfectly exact result cannot be assured by these methods, yet an answer may be obtained within any required degree of accuracy, by simply continuing the process, and since none of our senses are capable of appreciating differences beyond a certain degree of minuteness, it would be useless to continue the series beyond the point at which an error, in the observations upon which the calculation is founded, becomes imperceptible. The value of these approximate quantities then, will be simply a question of labour, and that must depend upon the rate at which the remainder diminishes in repetition. In decimals, this diminution takes place at the rate of a division by ten for each step, that is, if the figure which remained were always the same, as in the case of some repeating decimals, the error would be diminished ten times for every step in the process. It would, therefore, become so small in the course of a few places, that none of our instruments would, in practice, be capable of detecting it. If, indeed, we had the means of observing objects with perfect exactitude, it would be desirable to

employ such modes of calculation, as would ensure an exact result; but while all measurements are only accurate within a certain degree, it would be useless to found upon these observations a calculation more minute than the observation itself.

To illustrate the working of the method of approximation, let us notice the application of decimals to any very minute system of measurement, such as the micrometer, lately exhibited by Mr. Whitworth. This instrument, designed to ensure the utmost possible accuracy in lineal measurement, is capable of fixing the length of any substance placed in it, to within one millionth part of an inch, thus ascertaining the exact magnitude of an object which would be invisible even to the microscope. When a bar of steel, three feet long, was thus measured, the expansion of the metal produced by a touch of the finger, altered its length to the extent of one of these divisions; it seems, therefore that no object submitted to this severe test, would retain the same dimensions from one day to another, or even through the same day. Yet, to record the measurements taken by this instrument only six places of decimals would be necessary, using an inch as the unit; and the experiment, being the most exact of its kind ever made, may serve as a proof of the efficiency of decimal calculations in all ordinary observations.

A time may perhaps come, when some calculus more accurate, or more rapidly converging, may be required, as we can scarcely place a limit to the improvement of instruments; but the changes always going on in the magnitude of objects through the laws of heat and electricity, place great obstacles in the way of further improvement, and seem to ensure a very gradual progress. We need not therefore at present be under any apprehension that our methods of reckoning, either by decimals or series will require to be superseded.

Although no subject higher than trigonometry is at

present required from officers of the line, yet the great utility of some which follow will excuse a few sentences upon the method of acquiring them. The subject that has just been treated, is commonly followed by some elementary work on conic sections, a branch which is of inestimable value in astronomy, as well as in some other high subjects, and which is the foundation of the art of gunnery, but is not so likely to be useful to a soldier as statics and dynamics. The few principles concerning the parabola, which are necessary for the theory of projectiles, may be assumed for the time, since without them, many dynamical laws would be unintelligible; and it will be easy afterwards to go through the subject at length, if time permits.

Mechanics in its two branches of statics and dynamics is constantly useful, even in the affairs of civil life; and in military service will probably be more valuable than any other portion of the science. To those who have a taste for mechanical pursuits, it will be pleasurable as well as profitable, and to all, it will probably be more easy than the preceding subjects. A popular work will give as much information as will be required in practice, but one in which algebra is used should be selected, as there will then be less burden for the memory; and it would evidently be unwise to allow the previous subjects to escape for want of practice when they might be brought into useful operation.

It is not merely the power of calculating forces which gives this subject its greatest value. The habit of observing the relation between a force and the effect it produces, divested of extraneous considerations, prevents those extravagant mistakes, into which, persons unacquainted with mechanical laws are sometimes betrayed. If it were more generally studied, we should not so frequently hear of machines intended to generate or increase force by some internal faculty of their own, nor should we meet with calculations for practical purpose made with-

out reference to friction. To gain some of the most useful points of mechanical mathematics, profound study is by no means requisite; the mere fundamental laws, when thoroughly understood, will give more just ideas than can be obtained by practice alone, and they are perfectly intelligible to all who can read, and who possess therewith the faculty of thinking. The aid of a few equations, and some acquaintance with the formulæ, would enable any man to calculate to a nicety the power of the machine he proposed to use or construct, together with the requisite strength of materials, and thus to place his operations beyond the reach of chance.

No work will be found more convenient for the study of mechanics than *Goodwin's Course*, now in such general use among students at Cambridge. It gives the subject in a very small compass, and with great clearness and precision, and it requires no algebra beyond quadratic equations.

The last subjects to which the reader's attention will be called in this chapter, is the differential and integral calculus, in which he will make a retrograde movement from mixed to pure mathematics. This valuable branch is merely a mode of calculation more ready in its use, and extended in its application than can be found among the elements. It may be described as the highest step in algebra, absorbing by its superior power all that went before, it is therefore always regarded as a sort of standard of mathematical attainments; and those who have read the calculi are considered to have passed the elements, and commenced the higher order of investigation.

It is not, however, a very difficult subject, at any rate to one whose algebra was read efficiently; but some further acquaintance with that branch than has hitherto been proposed, will be necessary for any who wish to read the higher class of works. A little book called Ritchie's *Differential and Integral Calculi* will give a very fair idea of the subject without requiring any step

in algebra, beyond quadratic equations; those who have read their series well, and have a good idea of the nature of a limit had better use the treatise by Professor Hall, which for clearness and methodical arrangement could scarcely be surpassed. The last-mentioned work contains also a collection of examples at the end of each chapter which greatly assists the student, and it is much to be regretted that mathematical writers do not always follow this judicious system.

In the work last mentioned all the earlier chapters are devoted to the mechanical operation of finding the differential co-efficient, and they present perhaps less difficulty than will be found in the same number of pages of any other mathematical book. This mode of treatment possesses one great advantage, that it renders it possible to acquire considerable facility in the mechanical use of the calculi without thoroughly comprehending their fundamental principles, and thus places their practical advantages within the reach of some, who would never have appreciated their theoretical beauty. Such a qualification is indeed somewhat antagonistic to the plan I have hitherto proposed for the student's guidance, namely, to leave nothing behind which he does not understand; but it must be remembered that the calculi are not only a noble specimen of analytical reasoning, but are also a most useful method of calculation; and as there are many minds which would never get fairly to the bottom of the principles, it is better they should enjoy what benefit they can, than be denied all share in the utility of the subject. Of course such mechanical workers will be very inferior to those who understand the subject fully, since they can go just as far as they have been taught, and not a step further.

The smaller book, by Ritchie, requires the principle of limits to be understood from the first, and is, as I have found in practice, quite unintelligible to some scholars. It makes, however, an excellent companion to Hall's

treatise, and considering the difficulty of thus handling the subject, must be admitted to be a work of great merit.

It would be superfluous to give directions for reading the higher subjects with the aid of the calculi, as the student, who has advanced thus far, will have acquired the power of judging for himself; and it is to be feared that not many of the readers of these pages will be found among that number. Unfortunately, there are but too many who conceive a distaste for this class of studies, from the difficulty they experienced in the initiatory steps, and who consequently never place the subject on a true footing, or fairly balance its advantages with those of any other branch of human attainments.

The mathematical sciences are essentially the property of the understanding; they appeal only to reason, and profess to rise by regular steps, from self-evident axioms to the highest efforts of which the mind is capable. If they do not strictly carry out these professions, it is only that they share, in a very minute degree, the imperfection belonging to all human works; and a candid comparison with other branches of knowledge, would lead to a conclusion greatly in their favour.

In languages there is not much opportunity for the exercise of independent reason, since even in critical analysis, the data must be taken upon authority, and examined by the aid of established rules. In history, though abundant materials for reflection are supplied, those materials are taken upon the credit, not only of an author's honesty, but of his learning, vigilance, and discrimination. In neither case can the student depend entirely upon himself, or attain to a certain conviction; but in mathematics, at least in the pure branches, nothing is stated but what is self-evident, nothing deduced without absolute demonstration. The scholar carries the evidence in his own mind, he can contradict a fallacy from his own observation, exercised not through the doubtful medium

of the senses, but by the certain action of his reason. A well-trained school-boy is as sure within his limits as a philosopher; his school-fellow might instruct him, but no one can deceive him. In applied mathematics there is not indeed this absolute conviction. The data are the result of experiment, and must generally be received on faith; but the calculations founded on them are capable of being checked by more advanced observation. There is no balancing of probabilities, no discussion on either side to give room for subtile argument to defeat the truth. The observations are received conditionally; it is only the deductions that admit of no contradiction.

Chap. V.—FORTIFICATION.

THE RELATION TO THE VARIOUS BRANCHES OF APPLIED MATHEMATICS—DRAWING INSTRUMENTS—FIELD FORTIFICATION—ORIGIN AND PROGRESS OF THE ART—MODE OF FIXING THE DIMENSIONS—ELEMENTS OF VARIATION—CONSTRUCTION OF A PROFILE—CALCULATION OF DETAILS—CONTOURS—DEFILADE, MINING AND PERMANENT FORTIFICATION—VAUBAN'S FIRST SYSTEM—THE LATER SYSTEMS—OBSERVATION OF REAL WORKS—HISTORIES OF SIEGES.

A CIVILIAN publishing a treatise upon fortification, would be in much the same position as a physician writing upon seamanship, or a sailor upon surgery. There is, however, in all arts or sciences, a theoretical, as well as a practical division, the latter belonging essentially to the profession, the former open to all who will bestow upon it the necessary labour. It is needless to say that the remarks which follow refer exclusively to the latter division, and are intended to show how particular treatises may be read and *understood* by those who have as yet no practical acquaintance with the profession of arms. In this respect military science stands upon the same footing as the various branches of applied mathematics, to which indeed it is sometimes said to belong; for as in mechanics, pneumatics, and astronomy, certain experiments and observations, which the scholar has no opportunity of making for himself, are taken upon the credit of those by whom they were published; so in this subject, the effect and range of projectiles, the space required for the manœuvring of troops, and many other data must be taken for granted on the authority of those who have deduced them from experience.

Although an opportunity of studying fortification in the field will not generally present itself before the entrance examination, there is a kind of intermediate course half way between theory and practice which may be pur-

sued at home, and will at least prepare the learner to avail himself of the first practical opportunity that occurs. This course is simply to pay great attention to plan drawing, and to make or consult models as often as possible. Some directions will be given on this subject hereafter, and for the present it may be as well to remark that a large and costly box of instruments is by no means necessary: a pair of compasses, with pen and pencil to shift, a set of Marquoise scales, and an ivory protractor, will carry the student through a very fair course.

Field fortification is the most convenient branch for the first essay, as the constructions are simpler than in the permanent systems, and the reasons for every step are easily intelligible, without reference to trigonometry. Moreover, there is a latitude allowed in most of the dimensions, which is favourable to a real comprehension of the principles, and allows room for illustrating them, not only by a diversity of the plans, but by examples for the application of arithmetic and algebra. In this branch, the attention is necessarily drawn in the first place to the profile, which should be examined in all its different forms, before proceeding further; and several rough plans may be drawn, to illustrate its changes, as occasioned by the height and thickness of the parapet, or the character of the ground. An attempt might also be made to follow the history of the profile from the time when it was a simple mound or bank of earth, till it attained its present form. If the materials were at hand, it would be very convenient to study the real history of all the improvements, as they came one by one into use; but in the absence of records, a great portion of the advantages of such a course may be obtained by making out the history from probabilities. The surest way to understand the value of any improvement is, to enquire what defects it was intended to correct, a point which may often be ascertained from evidence contained in the alteration itself.

The student can picture to his mind the train of thought

which might have occurred to a commander, who, without any system to guide him, was required to shelter his men from missile weapons, with such materials as an open plain supplied. By following in regular order the alterations that would suggest themselves, a series may be established, which will not be very far from the truth; and as the exercising of the understanding is all that is required, the present purpose will be sufficiently answered.

Placed in the situation we have supposed, a soldier would speedily decide that his only course was to throw up a bank of earth, to obtain the material for which a ditch must usually be dug, when it would be convenient to place the bank or parapet close behind it, where both might contribute to the defence. Such a parapet would at first be rude in structure and of irregular dimensions; and, indeed, it appears actually to have remained in that state for a very long period, during those ages when the absence of artillery, and the weight of armour were all in favour of the defenders.

As missiles improved, the parapet would be increased in height, to eight or nine feet, and in thickness, perhaps, to the same dimensions; it would then become necessary to shape the earth into a regular form. At first it would probably be flat at the top, and sloping off on either side at as great an inclination as the soil could be made to retain; but such an arrangement would protect the assailants as well as the defenders, the latter would therefore erect a smaller bank of earth inside the parapet, upon which the men could mount when required to fire upon an approaching enemy. The distance between this terrace, called the banquette, and the top of the parapet would be decided by the height at which, a man of ordinary stature, fires his musket. To prevent confusion, the men would not be allowed to mount the banquette with a jump, but an easy slope would be provided from the tread to the level ground.

In this state the profile would nearly approach its pre-

sent form, and would probably remain thus for a long period, the experience of individuals modifying it in various ways, but no established rules being adopted. Indeed, it may generally be observed, that in all matters of a mechanical character, the practice frequently leads the theory, and improvements are long recognised as a part of the *art*, before they are admitted to a place in the *science*.

In actual experience, however, it must soon have been noticed that the troops mounted upon the banquette, could only discharge their weapons in a horizontal direction; and that the enemy escaped under their fire as he approached the ditch. This would be remedied by sloping the top of the parapet towards the open country, sufficiently to allow the defenders to see an enemy standing at the outer edge of the ditch. The top of the parapet would then be no longer a flat surface, but would have what is called a superior slope. Finally, it would be found that some slopes required, from various causes, to be steeper than others; thus the exterior slope would be the least, because exposed to the fire of artillery, and the escarp less than the counterscarp, because the weight of the parapet had a tendency to crush it in, while the more effectually to guard against this last accident, a space called the berm would be left between the exterior slope and the escarp. Though this is a mere repetition of what may be found in any work on fortification, it may serve to suggest a method of examination which will prevent the danger of overlooking the principles. There are, also, some peculiarities in the mode of fixing the dimensions, which, though common to the whole science, may conveniently be noticed in reference to the profile.

The continued variation in the circumstances to which the rules of fortification are to be applied, requires that the results should be given, not in a definite figure as in most mathematical sciences, but in the form of a maximum and minimum, between which the dimension should lie. Even in permanent fortification, where the elements of

variation are much reduced in number, there is still considerable latitude, as may be shown by the very different accounts, which various authors give of the same system. The reason of this divergence is, that every dimension, whether horizontal or vertical, has been chosen as the best medium between two opposite advantages or defects; and the exact point must be a matter, not of calculation, but of opinion. Room is thus given, not only for contrariety of judgment among different men, but even for change of opinion in the same writer.

As far as the permanent systems are concerned, the readers of these pages will not be troubled with much latitude, as the minor points have long been settled by different engineers, and the results are given in a form sufficiently absolute. But in field fortification, owing to the number of circumstances which have to be considered, nothing more can be done than to fix a pretty wide limit, and leave the rest to the judgment of the officer in command. Nor will this appear surprising, when it is considered that such questions as *climate, soil, the contour of the country, the force and armament of the enemy, time, and the number of the garrison*, have all to be considered.

But in proportion as an officer's judgment is left to its own resources, the responsibility and difficulty of his task increases, and it is only necessary to glance through the pages of any work upon Field Fortification to be assured, that a mere knowledge of the customary dimensions, without a thorough acquaintance with the principles, would be useless. These principles, let it be observed, are widely different from the efforts of abstract reasoning, upon which the formulæ of pure mathematics depend; they are, on the contrary, the facts which would most readily present themselves in actual service. An officer who had taken a part in the defence and attack of field works, would have commenced his studies by learning the reason for every thing, in the best of all schools, and if he afterwards studied the theory from books, would remember

the rationale more easily than the details. On the other hand, those scholars who begin in the study, start for the same goal from an opposite quarter—the rules and dimensions are as obvious as printing can make them, while the motives, however clearly explained, require an exertion of the faculty of thought which to many is highly distasteful. There is nothing except their own good sense to prevent this class of learners from committing the details of an elementary book to memory without at all troubling themselves with the reasons. If, however, they will examine a few of the questions which have to be decided before the dimensions even of a profile can be determined, they can scarcely fail to see the worthlessness of information so acquired.

In the first place, the height of the parapet must be determined, by the elevation of the spot, compared with that of the surrounding country. Its thickness will depend upon the kind of artillery likely to be employed against it, and may range over any space between three and fourteen feet; but the character of the country must often be known to a considerable distance before it can be decided with certainty whether heavy artillery, field guns, or small arms, can be brought into play. When the height and thickness of the parapet are determined, each slope will become the subject of fresh deliberation. The superior slope must not be too great, as in that case the crest, weakened by the loss of earth in front, would be reduced too much for safety; neither must it be so small as to protect the enemy as he approaches the ditch. In the same way the slopes of the escarp and counterscarp should be as steep as the nature of the ground will allow; but not so much so, as to incur the smallest danger of giving way. When all these points are determined, the dimensions of the ditch must be so calculated as to yield the exact quantity of earth required for the parapet; and if precautions were not taken to ascertain the character of the ground, it might at last be found that only three or four feet of

moveable soil was to be found upon the substratum of rocks.

In all these details there is abundant opening for a mistake; but if they detract somewhat from the exactness of the study, it must be admitted that they also greatly relieve its dryness; as, by obliging the reader to enter into the same questions which would engage the attention of the actual defenders, they communicate to the subject the same kind of interest which belongs to the real history of warlike operations. Much of the information that is requisite to form an opinion on such points cannot be gained from books; but the habit of considering them may be acquired in the study, and will not be entirely lost, even though many years elapse before an opportunity offers of applying the finishing touches by actual experience.

Before quitting the profile, the student should acquire considerable readiness in calculating the details from given data, and should draw several outlines upon the dimensions he has selected. Thus, he may illustrate the different modes of shaping the ditch, whether with steep sides, or at the natural slope, or meeting at a point. Those who have read a few pages from their treatise, will not require to be informed, that, with the height and thickness of the parapet given, and the depth of ditch, they are in a position to calculate the rest, but for the sake of practice in computing the different dimensions, the data may at first be taken from such a table as that in Captain Macaulay's work, only the parts that are there omitted being calculated, and when some facility has been acquired in this step, the dimensions of the ditch necessary to supply a given parapet may be calculated. It is hardly necessary to say, that the quantity of earth taken from the former, must be just sufficient to form the latter, with or without a glacis, that is to say, the superfice of the parapet and glacis in the profile taken together, will be equal to the superfice excavated from the ditch. In the first attempt, it may be

convenient to leave out of the question the increased bulk of the loosened earth; and as some readers may never have attempted to compute a superfice, it may be allowable to give a few simple directions on the subject.

Having made a rough sketch of the parapet and ditch, let perpendiculars be drawn from every angle to the ground line. This will divide the profile into a number of right-angled triangles and trapeziums, the latter having two parallel sides. The surface of each triangle will be obtained by multiplying together the sides which are at right angles to one another, and dividing by two; that of the trapeziums will be found by adding the two parallel sides together, and dividing by two, to find what is termed a mean, and multiplying that mean by the perpendicular distance between the parallel sides. The ditch itself is a trapezium, whose area may be obtained by finding a mean between the breadth of the top and that of the bottom, and multiplying by the depth. It is unnecessary to mention that the width of the ditch may conveniently be assumed, and the process finished by an equation.

Those who have examined critically the construction and dimensions of the profile, will not need much assistance in extending their researches into the subject of contours, as the habit of seeking a reason for every thing will not forsake them, and abundant explanation is afforded in the treatises of Captain Macaulay and Major Straith. Plans should be drawn of all the works which are in common use, beginning with the redan or lunette. These should not be mere outlines, but should have a separate line to represent every angle formed by two slopes. The figure will thus be traced by a number of parallel lines, the interval between which is of course the horizontal distance, and not that which would be obtained by actual measurement of the sloping surface. By describing the full width of the parapet, the habit will be acquired of allowing for it in the construction of flanks

and other works, whereas, if several plans have been drawn in outline, the eye becomes habituated to look upon the parapet as a mere wall, instead of a mound of earth of considerable thickness. In attempting to draw a star-fort with its slopes, the student will be surprised at the extent to which the flanking fire is masked by the adjacent parapet, and will readily understand the remark of Baron Jomini, that "Star-forts are the very worst description of fortification."

The bastioned and demibastioned forts, will form a very neat plan upon the same sheet of paper. The half of each fort being represented with all the slopes and their profiles annexed, they may be executed to the utmost of the draughtsman's power, and preserved as specimens of his skill.

After recommending the execution of a great number of plans, it may be necessary to add a caution against allowing this part of the study to occupy too much time. Finished drawings employ too many hours and days to be often repeated; three or four should be sufficient, and upon these the utmost care may be expended. The remainder may be drawn quickly without attention to minute exactness, and it will soon be found in practice, that a looseness of drawing only perceptible upon close examination, will very much shorten the operation. This must not be understood as a recommendation of careless and slovenly work, which is always inexcusable. Blots, smears, and lines, in the wrong place, with palpable erasures, and other symptoms of inattention should be held fatal blemishes; the artist will consult his own credit, by putting such specimens in the fire. But for the purpose of acquiring a more definite notion of a particular work, a plan may be drawn upon loose drawing paper, and as quickly as may be consistent with reasonable care; the act of drawing it, and the calculation of details will greatly assist the head without discrediting the hand. In all plan drawing, the details should be calculated

and learnt, before the plan is begun, that the work may go on without interruption, and that the repetition of the dimensions during the execution, may fix them upon the memory. The habit so often adopted of writing them on paper to be at hand for reference, is for this reason objectionable, and all *copying* of plans by compass and ruler without ascertaining the dimensions, is the act of a schoolboy.

The chapters in the works before mentioned, which refer to obstructions, are too simple to be misunderstood; but that upon *defilade* is less easy without being less important. Undoubtedly, an acquaintance with the eleventh book of Euclid's elements, would here be found an advantage, as the properties of a plane would then be familiar; but there is nothing in the subject which absolutely requires such preparation. If any great difficulty should be found in understanding this point, an attempt might be made to render it mechanically intelligible by representing each plane by a sheet of paper held in the proper position. The subject of mining is not generally attempted at an early part of a military education, as the details are dry, and by no means easy to remember, yet it may be read with advantage, as that in which every soldier may at some time be interested. The chapters on reconnaissance, the attack and defence of posts, the passage of rivers, will scarcely be omitted from their obvious importance; but there is danger of reading them too hastily, as the spirited style in which they are handled by the authors alluded to, gives them a very stirring interest. The student must not forget that to him they refer to important matters of business.

These subjects conclude the course of field fortification, and the permanent systems should now be studied with the care suited to a higher branch of the science. It has already been mentioned that this portion of the subject bears the stamp of its mathematical basis more dis-

tinctly than that which preceded, and is more rigorous in its details. This arises simply from the fact, that regular fortifications are constructed at leisure with unlimited command of labour and materials, almost the only accidental element likely to interfere with the established rules, being the shape of the surrounding country. But although the dimensions assume a more definite form, and are generally represented by a positive number instead of a limit, each separate number has been decided by balancing two or more conflicting advantages in precisely the same manner as in the looser system. The result has a more exact form, only because the data are much the same for all works of the kind; whereas, in field fortification, they are continually varying.

Since then there is so much to be understood, and so much that must be taken for granted, it becomes of great importance to select some treatise that makes every thing as clear as possible, and never resorts to a dogma when it is possible to give an explanation. In our language, there is little choice of books; but the first which usually presents itself, Straith's *Essay on Fortification*, with his larger work, entitled, *A Treatise on Fortification and Artillery*, will give an excellent idea of the subject. Sir Charles Pasley's *Course of Elementary Fortification*, originally prepared for the military students at Chatham, could not easily be surpassed, either in methodical arrangement or lucid explanation. Those who wish to extend their reading beyond the works already mentioned, might consult St. Paul's treatise in the French language. This author has handled his subject in a style, even more than explanatory, weighing the reasons for and against every detail with the laborious care suited to a question still open and undecided. Such a method of writing has considerable advantages, as tending to keep the mind in constant activity.

The base of all modern fortification is to be found

in Vauban's First System; the principles of the science are there developed, the succeeding methods being only slight alterations in the details. It will be evident then, that no pains should be spared in gaining a thorough insight into this system. Some acquaintance with the profile is desirable at the commencement, lest the idea of a ditch and parapet, as learnt in field fortification, should be transferred to this branch, where it would render all the dimensions of the ground plan unintelligible. The presence of the rampart will add little to the difficulty, as its uses and dimensions are very simple, but the profile must be understood to be taken on a line, which shall be always at right angles to the part of the work described. This is necessary, in order that it may represent the true dimensions of the slopes, which would not be the case if it cut them at any other angle; the definition of a profile, however, ought to anticipate any doubts upon this subject, if it received proper attention.

One use that may be made of the profile should not pass unnoticed, as it enables a distance of some importance to be ascertained without reference to trigonometry. In order to enter into the considerations which led to the position of the flank, and length of the face, it is necessary to know the point at which shot from one of the flanks would strike the ground. To find this, draw a simple profile of the rampart, parapet, and escarpe, leaving the width of the ditch unlimited, then by tracing across the parapet a line to represent the sill of an embrasure, and producing it till it meets the bottom of the ditch, the point at which a shot from the flanks strikes the latter will be fixed. The distance may be ascertained by measuring it with compasses, and comparing it with the scale. This question being determined, the necessity of leaving a certain distance between the flanks will be manifest; and the reasons for all the principal dimensions of the outline

will be tolerably simple. The student, must not, however, conceive that it is possible for him to understand the rules of fortification with the same entire and satisfactory mastery that he might have obtained over the theorems of pure mathematics. It has been shown already that they are, for the most part, a choice of evils; the sacrifice of one advantage to obtain another. It is competent to all to learn what the questions were, which were thus treated; but to weigh them one against the other, to balance the incompatible benefits, and fix the mean point, is only given to practical experience. Still there should be nothing to discourage him from entering upon the investigation, and pursuing it as far as his powers allow; when he has reduced it to that purely practical alternative which nothing but experience can decide, the final decision may be accepted as an experimental truth in the same manner that the basis of all applied mathematics has been received.

No safer method of studying fortification could be devised, than that which has been adopted in most of the works of recent date, namely, by its history. Those who have traced the course of improvement from the early and rude attempts of the middle ages, will have become so well acquainted with the necessities of the case, that they will be prepared to appreciate each alteration as it comes, and will look upon the simple and accurate system of Vauban very differently from those who have known no other. Fortunately, the materials for this mode of study are abundant, and can be found in most books upon the subject. The system of attack is also an essential supplement to that of defence, which it serves to illustrate and explain; and it would be safer to keep the acquaintance with both to about the same level; thus after reading an outline of the construction, it would be well to read a similar account of the attack; and before passing from the method of

Vauban to that of Cormontaingne, a complete plan of the attack upon the former system might be drawn. This is not in conformity with the routine commonly pursued, in which the modern system is read before any of the methods of attack, but it seems more eligible, as the improved methods of construction will be better understood when it is known what defects they were intended to remedy. The later systems are somewhat more complicated than the first of Vauban; but the fundamental principles are the same, and in acquiring them, the student has only to observe the reason for each alteration, to make himself tolerably sure of retaining it in his memory.

There is no surer mode of realizing and testing a knowledge of fortification than that of applying it to real works. We have not, it is true, a very large number of fortified places in England, but some of them are by no means difficult of access. It is not absolutely necessary to study all the details, as this can be done from plans and models; the chief advantage of examining the real works is, to correct the inadequate notions of their magnitude so commonly entertained by beginners. For this purpose, one visit to Chatham would be sufficient, and the time would be well employed. Those who reside in London, should, by all means, examine the collection of models at the United Service Museum, the access to which is on a very liberal plan; they will there find examples of all the principal systems, some of them exceedingly complete; and if previously prepared to understand what they see, they can scarcely fail to gain some new ideas.

The finishing lessons in fortifications will be obtained from the historical accounts of actual sieges, which are tolerably plentiful in all languages, and among which, that by Sir John Jones, occupies one of the highest places. If the study of this branch of science commences with some rather dry details, it must be admitted on all hands, that it speedily leaves them behind, and

takes its path among the most stirring scenes in the history of man. The student who is wont to seek excitement in fictitious adventure, may find it here in full measure, without passing the limits of truth, and may indulge his taste by reading the achievements of others, while he prepares himself to follow their course.

Appendix.

OFFICIAL PAPERS

RELATING TO THE

EXAMINATIONS AND QUALIFICATIONS

REQUIRED OF

CANDIDATES FOR COMMISSIONS

AND ALSO OF

OFFICERS ON PROMOTION.

All British subjects are by law eligible to hold command in the Army, with the consent of the Crown.

Extract from *The Law relating to Officers in the Army*.
By Harris Prendergast, Esq.

All persons born in the British dominions are, by law, eligible to hold command in the Navy; and by the present Charter of the East India Company it is declared, that no native, nor any natural born subject of the British Crown resident in India, shall, by reason of his religion, place of birth, descent, or colour, be disabled from holding any office or employment under the Government of the Company.

Extract from *The Law relating to Officers of the Navy*.
By the same Author.

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Memorandum of the points upon which Candidates are to be examined, before they are recommended for Commissions*.

(A)

In order to have some certainty that the Applicants for Commissions in Her Majesty's Service have been educated as gentlemen, it is proposed that each of them should be examined by persons to be appointed by the Commander-in-chief for that purpose, particularly on the following points, before they can be recommended for commissions.

1 The Candidate should read English correctly, and write it from dictation.

2 In Arithmetic, he should be acquainted with the four first rules (simple and compound), and proportion.

3 In Languages, it is desirable that he should understand the Latin Grammar; be able to construe Cæsar's Commentaries (exclusive of the portion ascribed to Hertius), and parse if required; this should include syntax and prosody. If not master of the Latin Grammar, and he should not have received a good classical education, he should thoroughly understand the French or German Grammar.

4 In History, he should have read Hume's History of England with Smollett's Continuation, also a History of Rome and Greece, and of Modern Europe. He should moreover be able to answer such questions on the subject as may be proposed by the examiners.

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* The papers (A & B) are the first and last that have issued from the Horse Guards for Commissions in the Queen's Service. Those which intervened were nearly similar to one or the other, and contained no subjects higher than are given in the latter.

5 In Geography, he should possess a competent knowledge of the general divisions of the world; the name of the capital of each nation in Europe, the principal rivers, sea ports, and military posts in Great Britain and Ireland; Her Majesty's Dominions in every part of the world.

6 In Fortification, he should have read some easy work on the subject, and have received some instructions in drawing.

7 If the Candidate be a member of the Church of England, he will have to produce a certificate of having been confirmed; if not a member of the Church of England, he will be required to produce a certificate from a minister or priest, stating that he has been well instructed in the principles of the religion in which he has been brought up.

8 A Medical Examination will take place to ascertain that the Candidate is in every point of view fit for Military Service.

(B)

1 The Candidate must be able to read English correctly, and write it from dictation.

2 In Arithmetic, he must be acquainted with the four first rules (simple and compound), proportion, fractions, the use of logarithms as applied practically to multiplication, division, formation of powers and extraction of roots (Scott's Arithmetic).

3 Algebra, so far as to include addition, subtraction, multiplication and division of both integer and fractional expressions (Articles 1 to 34 of Scott's Algebra).

4 In Languages, he must be able to translate any passage in Livy's History of Rome (Books 21 to 25 inclusive); and also any portion of Virgil's Æneid (Book 1 to 3 inclusive), with parsing and prosody. If he should not have received a classical education, he must

be able to render into English a given passage either from a French or from a German author (as he may himself prefer), and parse; and he must in addition translate into French or German a passage selected by the examiners from an English author (in French, Vertot's Revolutions of Sweden and Portugal; in German, Schiller's Revolt of the Netherlands; in English, Lord Dover's Lives of Sovereigns).

5 In History, he must be able to answer such questions as may be proposed by the examiners.

6 In Geography, he must possess a knowledge of the general divisions of the world; the name of the capital of each nation in Europe, the principal rivers, sea-ports, and military posts in Great Britain and Ireland, Her Majesty's Dominions in every part of the world (Butler's Geography).

7 In Fortification, he must be able to trace upon paper, in presence of the examiners, a front of fortification according to Vauban's First System, and also the profile of a rampart and parapet. If the Candidate can perform this correctly, it will be received as evidence of his having acquired some knowledge of drawing (Straith's Introductory Essay).

8 If the Candidate be a member of the Church of England, he will have to produce a certificate of having been confirmed; if not a member of the Church of England, he will be required to produce a certificate from a minister or priest stating that he has been well instructed in the principles of the religion in which he has been brought up.

9 A Medical Examination will take place to ascertain that the Candidate is in every point of view fit for Military Service.

Regulations for the Admission of Gentlemen Cadets into the Royal Military Academy at Woolwich.

1 It has been customary with the Master-General of the Ordnance not to register the name of a boy as candidate for admission to the academy previously to his being ten years of age. And no young gentleman can be called up for examination whilst he is under the age of fourteen; nor can any one be admitted as a cadet after the age of sixteen. A certificate of birth, taken from the parish register and signed by the minister and churchwardens, must be transmitted to the Master-General's Secretary, at the Ordnance Office in Pall Mall, *and also an address, to which instructions may be sent when a vacancy occurs.* If the parish register cannot be resorted to, an affidavit or declaration before a magistrate from one of the parents, or from some person who can attest the fact, will be accepted. Each candidate will be expected to bring with him, on appearing for examination, a certificate of good conduct from the masters of the schools at which he has studied during the last three years. If a member of the Established Church, he will have to produce a certificate of having been confirmed; or, should he not have been confirmed, a certificate from the clergyman of the parish, or other clergyman of the establishment, stating that he is properly grounded in the knowledge of his religious duties. Candidates, not members of the Established Church, will be required to produce certificates from a priest or minister, stating that they have been well instructed in the principles of the Christian religion. Each candidate must also produce a statement from his parents or guardians whether he has had, or not, the small pox, cow pox, or meazles.

2 The following are the qualifications which will be required of every candidate, and in case of failure, it is to be clearly understood that no appeal for a further period for preparation can be listened to.

1 English—To write a good legible hand, and to write freely and correctly from dictation.

Mathematics at 14 *years of age.*

2 Arithmetic—including vulgar fractions, ratio and proportion; the rule of three and compound proportion; decimals; duodecimals; involution; the extraction of the square and cube roots; simple interest.

3 Algebra—the notation, and the four fundamental operations of addition, subtraction, multiplication, and division, on algebraic quantities.

4 Geometry—A clear comprehension and knowledge of the definitions, postulates, and axioms in the First Book of Euclid.

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5 Classics—to construe and parse Cæsar's Commentaries correctly.

6 French—to read and translate any easy French author, with parsing.

7 German—to read and write the written and printed characters, with competent knowledge of the declension of the articles and personal pronouns, and of the conjugation of the auxiliary, active, and passive verbs.

8 Geography—a general knowledge of countries, their position, capitals, rivers, mountains, and seas, &c.

9 History—a competent knowledge of English history, and a general acquaintance with the leading points of ancient and modern history.

10 Drawing—instruction in drawing to the extent of copying an easy outline.

11 Printing—to print the ordinary Roman character and italics, with neatness and facility.

3 The examination to the extent of the foregoing qualifications will be searching, but nothing beyond will be required from candidates of the age of fourteen years only. If the candidate exceed that age, the following proportionate advance in the mathematical course will be expected:—

Algebra, 14 years 6 months—common multiples and common measures; algebraic fractions; simple equations, containing only one unknown quantity.

Geometry—the first twenty-six propositions of the First Book of Euclid.

Algebra, 15 years—simple equations, containing two unknown quantities, with questions producing such equations; involution; evolution.

Geometry—the First Book of Euclid.

Algebra, 15 years 6 months—the various operations on surd and imaginary quantities.

Geometry—the first two Books of Euclid.

If more candidates than the number required to fill up the actual vacancies should acquit themselves to the *perfect satisfaction of the Board*, they will be admitted as vacancies afterwards occur; but, to entitle them to this their qualifications must in every respect be such as are required by these Regulations; and *no second examination will be permitted.* Although the examination for admission will not be carried further than the specified qualifications, any advance beyond, will, of course, lighten future studies, and facilitate progress through the Institution.

N.B.—The class books now in use at the Royal Military Academy are the New Elementary Course prepared for the Institution, Vol. I. for Arithmetic and Algebra, Potts' Euclid, Tarver's French Grammar and Exercises, and Troppaneger's German Grammar.

4 The candidates will be examined by masters, nomi-

nated for that purpose before a board, which will decide on their respective qualifications, and report to the Master-General those who are qualified for admission.

5 Each candidate is also to be examined by a surgeon of the Ordnance Medical Department at Woolwich; and if it should appear that he has any difficulty in articulation, or any mental, organic, or bodily defect, which may disqualify him for military service, he will be referred to a medical board, *whose opinion must be considered to be final.*

6 If he be found qualified, he will be admitted upon the principle of probation for two sessions of study, at the end of which period he will be examined as to his progress in his studies, and his conduct in every respect will also be strictly enquired into. Should the result of the enquiry as to his progress be unfavourable, he will be removed at once from the academy, unless it shall be shown that sickness, exceeding a period of two months, interfered with his studies; *in such cases, but under no other circumstances, a second trial will be granted.*— Should his general conduct be found irregular, he will be sent back to his friends. In case of decided idleness and incapacity, he will be liable to examination at any period, either previous or subsequent to the expiration of the twelve months, and should his progress or recollection of rules and principles fall palpably short of that fair proportion in any branch of study, which ought to be attained in the time he has been at the institution, or if he should fail to qualify himself for a commission at the end of four years, he will be removed from the academy.

Regulations of the Royal Military College near Bagshot.

Junior Department, January 1st, 1851.

No candidate can be admitted into the Junior Department of the Royal Military College under the full age of thirteen years, nor above that of fifteen. A baptismal certificate, under the hand of the clergyman of the parish where he was born, if in the United Kingdom, or if the candidate was born abroad, such other proofs respecting his age as may be satisfactory to the governor must be transmitted with the application for admission.

Every gentleman cadet is, at first, admitted upon a probation of twelve months; and if his conduct during any part of that period should be such as to make it obvious that his longer stay would be either hurtful to the institution or wholly unprofitable to himself, he will be sent back to his parent or guardian.

The following qualifications are required from every candidate for admission:

1 In English, to write from dictation.

2 In Arithmetic, he must be acquainted with the first four rules, simple and compound, and vulgar and decimal fractions.

3 In Algebra, addition, subtraction, multiplication, and division.

4 In Classics, to construe and parse Cæsar's Commentaries.

5 In Geography, he must have a knowledge of the counties, chief towns, and rivers of England, Scotland, and Ireland.

6 He will be required to print the ordinary Roman character and italics with neatness and facility.

If a candidate is found deficient in any of these elementary parts of learning, his admission into the college must be deferred until he is better qualified.

Every gentleman cadet on admission must also come provided, at his own expense, with the following articles:

Two cases of Mathematical Instruments, agreeably to pattern, which may be seen at Mr. Jones's, 4, Rupert Street, Haymarket, London; Scott's Elements of Arithmetic and Algebra, Synopsis of Geography, Cambier's French Grammar, Levizac's French Dictionary, Bible, and Prayer Book.

These books and instruments may be procured (if preferred by the parent or guardian) at the college, and must, in that case, be paid for on the admission of the candidate.

Senior Department.

1 A Candidate for admission to the Senior Department of the College, must be a Commissioned Officer in the Army, and must have completed the twenty-first year of his age. He must have actually served as a Commissioned Officer with his regiment three years abroad, or four years at home; unless he should have been reduced to half-pay before the completion of such period, when his claim will be considered.

2 His Application (addressed to the Governor of the College,) must be supported by satisfactory testimonials of character and conduct; as, likewise, of his being well grounded in the duties of the particular branch of service to which he belongs.

3 These testimonials must be from the Officer commanding the regiment in which he is serving; or, if on half-pay, from an Officer of Rank in the service.

4 Every Officer on joining the Senior Department, will be subjected to an Examination as follows; if deficient therein, he cannot be received into the Institution:

1 In Arithmetic, he must be acquainted with the first four rules, simple and compound, proportion, fractions, and the use of logarithms.

2 With Algebra, up to quadratic equations inclusive.

3 In Languages, he must have a knowledge of Latin, or French, or German, so as to be acquainted with the construction of one of them.

4 He must be prepared to answer such simple questions as may be proposed to him, in History and Geography.

5 In Fortification, he will be required to trace the magistral line of a front of fortification, according to the First System of Vauban; the profile of a field parapet, and show that he has received instruction in the use of mathematical drawing instruments.

5 The time prescribed for the course of Education at the Senior Department, is two years from the date of the admission of each Officer; unless he has been educated at the Junior Department, in which case, the period allowed is one year and a half only.

Revised List of Books which are likely to facilitate the Studies of Officers preparing for Admission to the Senior Department of the Royal Military College.

Butler's Geography; Cambier's French Grammar; Cambier's Recueil de Pièces Choisies; Cæsar's Commentaries; Eton Latin Grammar; Scott's Elements of Arithmetic and Algebra; Schiller, Geschichte des Abfalls der Vereinigten Niederlande; Vertot, Revolutions de Suède et de Portugal; Chepmell's Course of History; Straith's Introductory Essay to the Study of Fortification; Demmler's German Grammar.

Preparatory Instructions to Persons desirous of entering the Military Service of the East India Company.

Direct Cadetship.

Resolution of the Court of Directors, 7th December, 1808. *Act* 33 *Geo. III., c.* 52, *s.* 60.

A Candidate must have attained the age of sixteen years. He is not eligible to be appointed a Cadet after having attained the age of twenty-two years, unless he shall have been, for the space of one year at least, a Commissioned Officer in Her Majesty's Service, or in the Militia or Fencible Corps when embodied, and hath been called into actual service, or shall have been in the Company of Cadets of the Royal Regiment of Artillery. Such persons are eligible for the appointment of Cadet in the Company's Service, provided their age does not exceed twenty-five years. [A Commission in the Guernsey Militia, or in other corps similarly circumstanced, is not a qualification.—*Resolution of Court, 3rd April,* 1844.]

Resolution of Court, dated 31st July, 1821.

A Candidate who has been so employed must produce his commission, together with a certificate from the War Office or Commanding Officer of his regiment, of his having actually joined and done duty with the regiment for the full term of one year and upwards; and that he was neither dismissed nor resigned his regiment in consequence of any misconduct.

Resolution of Court, dated 19th June, 1833.

No person who has been dismissed or obliged to retire from the Army or Navy, the Royal Military College at Sandhurst, the Royal Military Academy at Woolwich, or from any other Public Institution, on account of immoral or ungentlemanly conduct, can be appointed a Cadet.

Resolution of Court, dated 22nd January, 1851.

The following are the points upon which Candidates are to be examined before they are passed as Cadets:—

1 Each Candidate will be required to write English correctly from dictation.

2 He should possess a competent knowledge of the ordinary Rules of Arithmetic, including the rule of three, compound proportion, simple and compound interest, vulgar and decimal fractions, and the extraction of the square root. He should also have read the first three books of Euclid.

3 In Languages, he should be able to translate into English, passages from Cæsar's Commentaries, or from the first four books of Virgil's Æneid, and he will be expected to parse, and show his knowledge of Grammar and Syntax.

The Candidate will be required to translate from French into English, an extract from one of the following works, viz., Telemachus, Voltaire's Charles the 12th, and Peter the Great. But the Candidate will have the option of being examined in the Hindustani, in lieu of the French language, and in that case, he will be required to translate from Hindustani into English, an extract from one of the following works, viz., Bagh-o-Bahar, Tota Kuhanee.

4 In History, he should be prepared to pass an exami-

nation in Keightley's Histories of Greece and Rome, in Gleig's History of England, and in the History of British India, contained in Vols. I. and II. of the Edinburgh Cabinet Library.

5 In Geography, he should possess a competent knowledge of the modern divisions of the world; the principal nations in Europe and Asia; the names of the capital of each nation in Europe, and of the chief cities of Hindostan; and the names and situations of the principal rivers and mountains in the world.

6 In Fortification, he should have read some elementary work on the subject (Straith's Introductory Essay to the Study of Fortification, or Macaulay's Field Fortification), and have received some instruction in Drawing.

Resolution of Court, dated 15th January, 1852.

The evidence to be required from Candidates of their having acquired "some knowledge of Drawing," is that they shall trace correctly upon paper, in presence of the examiners, a front of fortification according to Vauban's First System, and also the profile of a rampart and parapet.

The examination of the Candidates will take place before a Board of Examiners, to be convened for that purpose at the Military Seminary at Addiscombe, near Croydon.

Regulations of the East India Company's Military Seminary at Addiscombe.

1 No Candidate can be admitted under the age of fourteen, or above the age of eighteen years.

2 No person can be admitted who has been dimissed, or obliged to retire, from the Army or Navy, the Royal

Military College at Sandhurst, the Royal Military Academy at Woolwich, or from any other Public Institution.

7 Every Candidate is required to write a good legible hand; and to write English correctly from dictation.

He is also required to construe and parse Cæsar's Commentaries correctly.

He must likewise possess a correct knowledge of all the Rules of Arithmetic usually taught in schools, especially the rule of three, compound proportion, practice, interest, vulgar and decimal fractions, and the extraction of square root.

If a Candidate is deficient in any part of the preceding test, his reception into the Institution will be deferred for such length of time as the Head Master shall report to be necessary.

8 The qualifications mentioned in the last article are all that are absolutely requisite for the admission of a Cadet into the Military Seminary. Parents and guardians are however informed, that it will be of great advantage to a Cadet in his future studies at this establishment, if before being admitted, he make himself well acquainted with the following portions of the fourth edition of Cape's "Course of Mathematics," in the order in which they are given below, viz.:

1 Algebra, Part 1.
2 Geometry, chaps. 1, 2, 3, and 7.
3 The use of Logarithms.
4 Trigonometry, chaps. 1, 2, and 3.
5 Statics, chaps. 1, 3, and 4.
6 Dynamics, chaps. 1, 2, 3, 4, and 5.
7 Hydrostatics, and Hydrodynamics.

It is also very desirable that a Cadet on joining the Seminary, be able to draw with facility in pencil, and shade with Indian ink.

9 Every Cadet upon his admission, is considered a probationary pupil for the first six months, at the end of which period the public examiner will be required to report to the Military Committee, on the probability of the Cadet being able to pass for the Artillery or Infantry in the required period of four terms. Should this appear improbable, either from want of talent or diligence, the Cadet will then be returned to his friends.

14 The following class books will be provided at the public expense, the mutilation or destruction of which, to be chargeable to the Cadets, viz.:

Shakespear's Hindustani Dictionary.

Latin Dictionary.

15 The Cadets will, on their first joining Addiscombe, be supplied with the following books, the cost of which will be charged to the parents or guardians, viz.:

Cape's Mathematics and Logarithms; Straith's Treatise on Fortification, and Atlas; Shakespear's Hindustani Grammar; Shakespear's Hindu Selections; De la Voye's French and English Lexicon; Jackson's Military Surveying; Scriptore's Romani; Contanseau's French Grammar; Contanseau's Guide to French Translation; Contanseau's Prosateurs et Poètes Français; Ansted's Elementary Course of Geology, &c.; Penley's Treatises on Water Colours and Perspective.

Any books not included in the above enumeration, or which may be hereafter required at the Seminary, to be paid for by the Cadets.

Regulations in regard to the Examination of Officers preparatory to Promotion in the Queen's Service.

Horse Guards, 4th July, 1851.

The following Regulations in regard to the examination of Officers, preparatory to promotion in the Army, are to be substituted for those promulgated by the Circular Memorandum of the 14th May, 1850.

The qualifications required of Candidates for Commissions will be made known to their friends, and the time and place of examination will be stated in each case, so that the same may take place before any Commission is granted.

Before Officers are recommended for promotion to the rank of Lieutenant, the Commanding Officer is to have them examined by a Board of Officers, consisting of himself, another Field Officer, (if there should be one present with the regiment,) and the Senior Captain, and, if there should be no second Field Officer present with the regiment, then the two senior Captains present.

This Board is to report to the Military Secretary, for the information of the Commander-in-chief, that the officers about to be recommended for promotion to the rank of Lieutenant, have been instructed on the following points, viz:—

1 They must have a perfect acquaintance with the Standing Orders of the Regiments in which they are serving.

2 They must have a thorough knowledge, and must give an account, of the duties they have to perform as Regimental Orderly Officers, as Officers Commanding

Guards, or as Subaltern Officers of Guards under Officers of superior rank.

3 They must be able to put a company through the Manual and Platoon Exercise, and be capable of exercising both a squad and company in the Drill and Evolutions as prescribed in the first two parts of the Regulations for the Field Exercise of the Infantry.

4 They must know exactly the place of all the company officers in every situation of the battalion, whether in line, or in open, close, quarter, or half-distance column, and whether right or left in front.

5 They must be acquainted with the General Regulations and Orders of the Army, and with the Mutiny Act, and Articles of War.

6 They must be acquainted with the Queen's Regulations and Warrants in regard to the supply of necessaries to the troops, with the price of each article, and the regulations applicable to the same.

7 They must know the weight of the knapsack, the weight of the soldier's firelock, with and without the bayonet, of his pouch, with and without ammunition, the quantity of ammunition it is calculated to carry, and the weight of his accoutrements.

8 In addition to such portions of the above as may apply to the Cavalry Service, the Cornets must be required to be well acquainted with their stable and barrack duties, to have completed their course of instruction in the riding-school, and to be able to exercise a troop both on foot and mounted.

Lieutenants who may have entered the service subsequently to July 1842, and all who may hereafter enter the Army, will, in addition to the above, before they are recommended for promotion to the rank of Captain, be required to have—

9 A knowledge of Geography, so as to be able to state the general divisions of the world, the name of the

capital of each nation in Europe, and the principal rivers, sea-ports, and military posts in Great Britain, Ireland, and Her Majesty's Dominions in every part of the world.

10 The outlines of Grecian, Roman, and English History.

11 The first six books of Euclid's Geometry.

12 Geometry on the ground.

13 Algebra—comprising addition, subtraction, multiplication, division, the extraction of the square root, and the solution of simple equations.

14 Plane Trigonometry, comprehending the solutions of plane triangles in the three principal cases, with applications to the determinations of heights and distances (examples to be worked logarithmically).

15 Mensuration, including the determination of the areas of plane figures, rectilinear and circular, with the volumes and surfaces of solids.

16 Fortification, so as to be able to trace upon paper a front of fortification, according to Vauban's First System, with the profile of a rampart and parapet, and, in addition to state the names and uses of the different field works, from the redan to the bastioned fort, inclusive.

17 They must be perfectly acquainted with the provisions of the Mutiny Act and Articles of War:

18 And with the forms and proceedings of Courts Martial.

19 They must have studied some of the standard works on Courts Martial.

20 They must understand perfectly the evolutions of a battalion of infantry, or regiment of cavalry, as laid down in the regulations for those services respectively.

21 They must be acquainted with the Light Infantry Drill.

22 They must perfectly understand the interior eco-

nomy of a troop or company, the regulations for the messing and subsistence of the soldiers, and the established system of keeping their accounts.

23 They must be acquainted with the Royal Warrants which regulate the pay, provisioning, pensions, rewards, periods of service, clothing, and equipment of the soldier.

24 They must be acquainted with the General Regulations and Orders of the Army; more particularly with those for the government and management of the troops embarked in transport and convict ships.

25 And it must be ascertained that they are competent to take charge of a company or detachment, in every position in which it may be placed.

The examination of officers for the rank of Captain as far as relates to matters of regimental economy, detail, or discipline, is to be made by Boards of Officers, to be appointed by the Commanding Officer, consisting of the three Senior Officers of the regiment, and a report thereon is to be forwarded to the Military Secretary in every case of a Lieutenant recommended for promotion to the rank of Captain of a troop or company.

Any officer of the rank of Lieutenant in a regiment serving within the United Kingdom, who may have entered his name for the purchase of a troop or company, may apply, through his commanding officer, to be examined in respect to his required attainments, as specified in this order, upon which application the Commander-in-chief will give such orders as may be proper and necessary.

Orders will hereafter be given to provide for the examination of officers serving abroad, in respect to their qualifications and attainments, preparatory to their being recommended for promotion to the rank of Captain.

Lieutenants who entered the Army prior to July 1849,

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A

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